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CERTAIN PECULIARITIES OF THE COLEOPTEROUS FAUNA OF THE PACIFIC NORTHWEST.*

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When the Coleopterous fauna of that part of our country commonly spoken of as the Pacific Northwest is studied, certain evident and very interesting facts are brought out. Some of these were touched upon in a paper† dealing with geographical distribution, published some years ago. For instance, it was stated that the greater portion of the fauna was what I have called Vancouveran, that is, belonged to that aggregation of species characteristic of the cool and moist maritime belt extending from Southeastern Alaska to middle California; that on the higher mountains were to be found faunas which were more closely related to those now generally associated with the countries to the north and east and designated by such names as the Canadian, Hudsonian and Arctic; and that in that great area between the Cascades and Rocky Mountains would be encountered the fauna which I have named the Great Basin fauna, in reality a modified and attenuated form of the Sonoran. The general facts of distribution having been fully dealt with before, I shall not speak of those here. There are, however, many peculiar phases of the subject which I think merit a fuller discussion. Some of these I shall now proceed to amplify.

*Paper read June 17, 1925, before the Pacific Coast Entomological Society at the meeting held in Portland, Oregon, in conjunction with the Pacific Division of the American Association for Advancement of Science.

†"The Distribution of Insects in Western North America," by Edwin C. Van Dyke, Anns. Ent. Soc. Amer., Vol. XII, No. 1, (March, 1919), pp. 1–12.

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Take, for instance, the Vancouveran fauna itself. This is the dominant fauna of the region. Its characteristics distinguish it from all other faunas in America and yet it is complex. It is distinctly a Holarctic fauna, that is, contains in the main those genera and species which are to a great extent restricted to the temperate or more northern portions of the world. Such families as the Carabidæ, Dytiscidæ, Staphylinidæ, Dascillidæ, Melandryidæ and Cephaloidæ are much in evidence as also are those characteristic northern genera of the Elateridæ such as *Elater*, *Athous*, *Limonius* and *Ludius* (*Corymbites*). The great groups of lignivorous beetles such as the Buprestidæ, Cerambycidæ, and much of the Rhynchophora are in spite of the very extensive forests, not very numerous. From those other great northern regions like Europe, northeastern Asia and eastern North America which share with it the above mentioned peculiarities, it differs, though, in many regards. The great phytophagous families like the Scarabæidæ, Bruchidæ, Chrysomelidæ and the Curculionidæ which are so characteristic of the tropics and which have intruded to such an extent into the regions just mentioned as to become quite a conspicuous element, are represented in the Vancouveran fauna by but few species. The genus *Anomala* of the Scarabæidæ, well represented in Europe, the Japano-Manchurian region and eastern North America, is absolutely lacking along the entire Pacific Coast. The more typical members of the subfamily *Cetoninæ* or rose chafers like *Cetonia* and *Euphoria*, the typical genera of the Lucanidæ like *Lucanus* and *Dorcus*, share with *Anomala* the same distribution. In eastern North America we have *Phyllophaga* (*Lacnosterna*) with a large number of species and in eastern Asia, *Holotrichia*, a genus hardly separable, likewise abundant. In the true Vancouveran there is but one *Phyllophaga*, *P. errans* Lec., which has to any degree established itself. The same thing holds true with regard to the genus *Melanotus* of the Elateridæ. This genus is represented by many species in Europe, in the Japano-Manchurian region and in eastern North America and by one species, *Melanotus oregonensis* Lec., in reality but a subspecies of *Melanotus variolatus* Lec. of California, which is well established in the Vancouveran region. In the Chrysomelidæ and Curculionidæ, I shall also cite examples. The subfamily *Criocerinæ* of the former is well represented in all northern regions except the Vancouveran where it is

absolutely lacking and the same condition holds true with regard to the subfamily *Attelabinæ* or case rolling weevils of the Curculionidæ. In this connection a very peculiar fact is to be noted in that they are both especially evident in the Japano-Manchurian region and this region has many elements in common with the Vancouveran, but that is another story which will be taken up in detail later on.

In the Vancouveran region there are to be found certain Coleoptera which are restricted to it. Such are the cicindelid genus *Omus*, among the Carabidæ the subgenera *Pseudonomaretus*, *Pemphus*, *Brennus* and *Neocychrus* of *Scaphinotus*, *Metrius*, *Promecognathus* and *Zacotus;* and a large number of small or monotypical genera scattered among the various families such as *Areopidus* in the Dascillidæ, *Piodes*, *Xylostenus* and *Plectura* in the Cerambycidæ, and many genera of the subfamily *Otiorynchinæ* in the Curculionidæ such as *Amnesia*, *Dyslobis*, *Amotus*, *Sciopethes* and *Geoderces*, the latter extending somewhat beyond its confines. These are not only characteristic of the region but from the fact that in many cases they are widely isolated, show that the genera are not only endemic but very ancient. *Omus* is related to *Amblychila* of the region bounding the southern Rocky Mountains and Arizona but otherwise with no connections nearer than *Mantichora* of South Africa. *Promecognathus* has only one genus at all related to it in the world, the genus *Axinidium* of South and West Africa. *Metrinus* stands by itself, unrelated to any known carabid. The various subgenera of *Scaphinotus* are, of course, somewhat related to other subgenera found within the genus and are like them, purely American in origin. Judging from the number of species and distribution, the genus *Scaphinotus* was no doubt mid Tertiary in origin if not earlier. In fact, I believe that there was a fossil form found at Florissant, Colorado. *Zacotus* was placed by Horn* in a tribe by itself but it is no doubt quite closely related to the Broscini, a tribe with more members in the Eurasian region than in North America but still more dominant in Australia and New Zealand. *Promecoderus* of Australia looks very much like *Zacotus*. The Broscini is a very ancient group, now of but moderate size and widely scattered. The Vancouveran Otiorynchinæ have undoubtedly all originated within their present territory but the ancestral stock probably

*Trans. Amer. Ent. Soc., Vol. IX (1881), p. 169.

came from the ancient Holarctic fauna. In addition to the above endemic groups, we should also mention the subgenus Hypherpes Chd. of the great genus *Pterostichus* or *Feronia* as it may have to be called according to Mr. Andrews, an authority on the Carabidæ, which is characterized by having the elytra without evident foveæ. Though a number of these extend into the Rocky Mountains and even into eastern North America, chiefly along the Alleghanies, the great bulk of the species is to be found along the Pacific Coast. They are especially characteristic of the Vancouveran region and no doubt originated there.

The Coleoptera just mentioned, though they show the distinctness and age of the Vancouveran fauna, still do not throw much light upon its origin or the relationships of the fauna as a whole. Certain genera which I shall now discuss will, I think, do this. We shall take first some from among the Carabidæ. The genus *Trachypachus* which I have elsewhere recently discussed,† has three species found within this territory, one extending beyond it into the Rocky Mountains. Another species is found in the extreme north of Europe and in Siberia and two questionable forms, in the Amur region of Siberia. A related genus, *Systolosoma*, with one species is restricted to Southern Chili. These belong to a tribe which is one of the most isolated among the Carabidæ and undoubtedly very ancient as shown by the fact that the posterior coxal plates extend to the sides of the body as in the Dystiscidæ or water beetles. The true genus *Cychrus* has one species, *Cychrus tuberculatus* Harr., restricted to the Vancouveran region and another species, *Cychrus hemphilli* Lec., with its variety *rickseckeri* Lec. found, the first in the Wasatch Mountains of Utah, the second in the Coeur d'Alene Mountains of Idaho and the Bitter Root of Montana. These are quite closely related to *Cychrus morawitzi* Gehin (*convexus* Moran.) of Hokkaido, northern Japan, and *Cychrus koltzei* Roeschke of Vladivostok, eastern Siberia, as well as several species found in the high mountains of western China. The remaining members of the genus are found in Europe and Asia, particularly in the high mountains. The subgenus *Callisthenes* of *Calosoma* has a number of species and many subspecies found within the Vancouveran region and adjacent territory and also appears in the Aral-Caspian basin and the

†The Pan-Pacific Entomologist, Vol I, No. 3, (January, 1925), pp. 111–112.

extension of this semi-desert region eastward into southern Siberia and perhaps into Mongolia. *Opisthius richardsoni* Kirby, a common streamside carabid of the northwestern part of our country generally, has its only close relative, *Opisthius indicus* Chaud., in the foothills of the Himalayas. *Leistus ferruginosus* Mann., our only native species of the genus is confined to the Vancouveran region but the genus as a whole is widely distributed throughout Europe and northern Asia. Many of the species of the larger genera of Carabidæ like *Nebria*, *Amara* and *Platynus* also show similar relationships. That anomalous family Amphizoidæ, midway between the Carabidæ and Dysticidæ, has three species, two confined to the mountain streams of northwestern America and one, to the mountains of Yunnan in western China. The genus *Brychius* of the Haliplidæ has two species in Oregon and California and four other species in Europe one of which extends into Siberia and two localized to Sardinia and Italy. In the Silphidæ we have in the genus *Pteroloma* a peculiar group of beetles which dwell along the margins of mountain streams. Several species are confined to the Pacific Coast including Arizona, one to northern Europe and Siberia and a number to that complex of mountains along the southern borders of Siberia. Among the Staphylinidæ or rove beetles is an odd genus of flattened form, *Trigonurus*, which lives under the bark of coniferous trees, and which has six species ranging from Alaska to California, one in Europe and one in the Caucasus. A somewhat related genus, *Deleaster*, has one species in California, another in the southern Rockies, and in the Old World has one in China, one in Buchara, one in Europe and North Africa, and another in Abyssinia. Among the Dascillidæ, the typical genus *Dascillus* has two species confined to California, the remainder limited to Europe and western China. The genus *Hedobia* of the Ptinidæ is somewhat similar in its distribution, having three species in California and the rest in Europe and northern Asia, particularly in the Japano-Manchurian region. In the Cerambycidæ we have in the well known genera *Ergates*, *Notorhina* and *Rosalia*, genera which each have one species confined to the Pacific Slope but with others in Europe and the Japano-Manchurian region, while the peculiar *Plectura spinicauda* Mann. of the Vancouveran region has close relatives in Japan. The lucanid genus *Sinodendron* has but three species, one confined to the Pacific Coast, one to Europe, and the third to Persia. In the Curculi-

onidæ, we have in *Trachodes* a genus with several species confined to the northwest coast and with congeneric relatives in Europe and northern Asia. We also have many other genera which extend slightly beyond our territory but are dominantly centralized as regards number of species in the Pacific States. Such are *Malachius*, *Pedilus*, *Syneta*, *Pissodes*, *Phlœosinus* and to a great extent *Dendroctonus*. These also appear in Europe and the more temperate parts of Asia but are represented there by but few species as compared with what we possess. All of the genera recently mentioned and the list might have been extended without great effort, show that the Pacific Northwest and the Vancouveran region as its nucleus has a great deal of its fauna quite unlike that which is to be found in eastern North America and yet very much like that met with in Europe and northern Asia, particularly the Japano-Manchurian region.

What do these peculiarities of fauna which I have mentioned signify? To my mind they point out a number of very important facts which I shall now state. The first is that the fauna as a whole is in general related to those found in Europe, northern Asia and eastern North America and was like them derived from that great Holarctic fauna which covered the northern parts of the Northern Hemisphere during the Pliocene period. With the oncoming of the Pleistocene, this great fauna was forced southwards, and gradually broken up, that portion going south along the Pacific Coast of North America becoming in the main what I have been pleased to term the Vancouveran which is as far as general makeup is concerned, the equal of those driven south into the other great territories. The second fact is that the fauna as a whole is a very ancient one, perhaps to a great extent well established in its present territory even during early Pliocene times, this indicated by the large number of genera restricted to it and by the great number of distinct species as well as subspecies which many of them possess. In addition, the fact that many of these large genera or groups show a great degree of compactness as regards relationships seems to prove that the Vancouveran fauna covered for a long period quite an extensive area and was unmolested to a much greater extent than were some of the other faunas of northern origin. For instance, I do not believe that the great glacial streams which reached the sea along our northern coast during Pleistocene times exerted anywhere near as destructive an influence upon the fauna as did those great glacial blankets which covered

much of northern Europe and eastern North America during the same period. A third fact is that the Vancouveran is one of the most distinct of all the great faunas of northern origin. I have previously shown that it is very weak as compared with the other faunas in certain details notably in having but a limited number of such phytophagous families as the Scarabæidæ, Chrysomelidæ and Curculionidæ. It also differs markedly from that of eastern North America by having representatives of many peculiar genera which are not to be found there but occur in Europe and eastern Asia. Now why has there been that selection when all of the regions have drawn their fauna from a rich and apparently common previously existing fauna? I can account for that best by reasoning from the conditions which we have at the present day. I believe that during Pliocene times we had as now, an upland and more or less boreal fauna as well as a lowland fauna. The lowland fauna was somewhat tropical in its characteristics and more or less equally distributed throughout the great flat lands of the north. With the approach of a cooler climate, it readily migrated south into the lowlands of eastern Asia and eastern North America and less readily into Europe or perhaps there suffered more severely at a later period because of the frigidity of the climate as well as from the barriers which blocked its movements. Its progress south into western North America was very greatly restricted because of the barriers encountered, which were both climatic and topographical. On the other hand, the upland fauna, that of the mountains, high tablelands and more boreal regions generally when compelled to migrate south was because it was able to travel along the mountains and cool coastal areas, able not only to send a limited number of its species into Europe and eastern North America, but large numbers into western North America as well as eastern Asia. Thus we can account for the large number of peculiar genera and species which are to be found in the Vancouveran region that are related to others in eastern Asia and to a lesser degree, Europe. These are all forms of the mountains or of the cool lowlands. Long ago, Dr. Asa Gray when studying the flora of Japan, brought out the fact* that the flora of that country was

*"The Flora of Japan," "Scientific Papers of Asa Gray," Houghton-Mifflin and Sons, 1889, Vol. II, pp. 125–141.

Extract from "Memoirs on the Botany of Japan in its relations to that of North America, and of other parts of the Northern Temperate Zone," Memoirs Am. Acad. of Arts and Sciences, new series, VI, (1859).

more closely related to that of eastern North America than to that of either Europe or western North America. He was dealing with that of southern Japan. The flora of the island of Hokkaido or Yezzo, northern Japan, I do not believe would show such a close relationship. At any rate, the insect fauna does not. That of southern Japan shares with the flora, to a certain extent, its geographical relationships while that of northern Japan resembles that of our own Pacific Northwest. In a recent paper read before the National Academy of Sciences at Washington and of which there is a digest in "Science,"* the statement is made that the birds of eastern Siberia or "the Transyenissean species are strongly characterized, some presenting characters of relatively high antiquity; moreover, this group is intimately connected with the fauna of High Asia, many species reaching southwards as far as the southern limits of the Palearctic; some of the Transyenissean forms are surely of southern origin." This is also true of the Coleoptera as was very definitely impressed upon me in my trip through Japan, Manchuria and North China in 1923. The fauna of northern Japan and the mountains of China belongs with the Transyenissean and is, of course, even richer as regards the number of species and the ancient forms. This is also the fauna which shows a former affiliation with that of our own Northwest.

The distribution of the insect on the various mountains of the Northwest is their peculiar and interesting. I can show this best by tracing out the distribution of the carabid genus *Nebria*. I shall also include California with the area under discussion. The genus *Nebria* is a very large and yet circumscribed genus, highly characteristic of the Holarctic. The species are always found in damp situations, as a rule near running water, melting ice or along the seashore. The majority also prefer cool climates, hence are most evident in the far north or on the high mountains, but few being at home in the lowlands of the warmer parts of the world. The genus is thus a typical genus of the boreal regions and having originated in the north and lived in more or less close association with the ice or the ice streams emanating from the same, has to a certain extent advanced and retreated as the ice fields have. The

*"Outlines of the history of the recent fauna of Palearctic Asia," by Prof. Peter P. Sushkin, Russian Academy of Sciences, "Science," Vol. LXI, No. 1585 (May 15, 1925), pp. 522–523, and Proceed. Nat. Acad. Sci. of U. S., Vol. II (June, 1925), pp. 299–302.

distribution of the species at the present day thus throws a good deal of light upon the former distribution of glaciers and ice packs and their relation to each other. It is because of this and the knowledge that glaciers have greatly influenced insect life in all regions where they have been found that I offer the following notes.

In the region under discussion there are to be found at the present day, twenty-five species of the genus *Nebria*. They are in the main more or less restricted to the following localities: the seacoast, the lowland streamsides and the mountains. In our territory the latter are the Coast ranges, the Cascades with their continuation north into the Selkirks of British Columbia and south into the Sierra Nevadas of California, and the Rocky Mountains. In the Northwest there is to be found but one truly seacoast species, *Nebria diversa* Lec., which ranges along the coast from British Columbia to Crescent City, California. It is of a more or less uniform straw color and is to be met with during the day under rubbish or in the crevices of the banks back from the water. In Alaska there are other maritime species as well as one or two of the fluviatile species which occasionally follow the streams down to tidewater. Along the lowland streams there are four species which are characteristic of such situations: *Nebria metallica* Fisch., *Nebria virescens* Horn, *Nebria mannerheimi* Fisch. and *Nebria escholtzi* Men. The first, a brilliant violet or copper colored species, lives along the margins of the streams which flow into the Pacific Ocean from the mid Aleutian Islands to northern Washington and in places has followed the rivers through the gaps in the mountains well into the interior for it is to be found at Glendora, British Columbia, and at the western base of the Bitter Root Mountains. *Nebria virescens* Horn, a greenish species, dwells in damp situations throughout the Puget Sound Basin and the Willamette Valley. *Nebria mannerheimi* Fisch., an all black species, ranges from southeastern Alaska to middle Oregon and like *metallica* follows the streams far inland, and *eschscholtzi* Men., a dark brown species with yellow legs, ranges from British Columbia to southern California, in the southern portion of its range retreating to the mountains. On the coastal ranges of the north such as the Olympics and the mountains of Vancouver Island and Baranoff Island in Alaska, there are to be found five species: *Nebria sahlbergi* Fisch., *Nebria columbiana* Casey,

Nebria piperi Van Dyke, *Nebria gebleri* Dej. and *Nebria crassicornis* Van Dyke. None of these, however, is restricted to the coastal mountains but is to be found as well on the Cascades. The true *sahlbergi* is found throughout the coastal ranges from near Sitka to the Olympic and farther inland ranges from the Selkirks of British Columbia to Mt. Hood and Mt. Jefferson in Oregon. The species spoke of in the Rocky Mountains and in eastern North America as *sahlbergi* are not such. *Columbiana*, a species with elliptical violet wing cases besides being found on the Olympics, ranges through the Cascades from the Selkirks to Mt. Hood. *Piperi*, a large and very beautiful violet species, I have from the Olympics, Mt. Baker, Glacier Peak and Mt. Rainier. *Gebleri*, a small and brilliant copper colored species, is to be found throughout the coastal mountains from Sitka to the Olympics, in the inner range from the Selkirks through the Cascades to Mt. Adams and Mt. Hood and in the Rocky Mountains from north of Banff, Alberta, to the Bitter Root Mountains of Montana. It is a species of wide vertical range, hence has been able to spread over a greater territory than the preceding. *Crassicornis* has so far been found only in the Olympics and Glacier Peak and Mt. Rainier of the Cascades. In the Cascades, in addition to the above are to be found: *Nebria kincaidi* Schwarz, *Nebria meanyi* Van Dyke and *Nebria trifaria* Lec. The first was described from near sea level at Farragut Bay, Alaska, where the glaciers approach the coast, later discovered on Mt. Rainier, Mt. Adams and Mt. Hood. It is a brilliant copper colored species, with rounded humeri and related to *columbiana* of the north and *ovipennis* of California. *Meanyi* is a rare species of a purplish color, generally found with *piperi* along the sides of glacial rivers. I have it from Glacier Peak and Mt. Rainier. *Trifaria* is a very large black species only to be found high up along the margins of the snow packs and glacial rills. I have it from the Olympics, Mt. Rainier and also from the Wasatch Mountains of Utah and the Rockies of Colorado. From the northern Rocky Mountains we have in addition to three species previously mentioned: *Nebria purpurata* Lec., *Nebria schwarzi* Van Dyke, *Nebria labradorica* Casey, *Nebria hudsonica* Lec., *Nebria obtusa* Lec. and *Nebria obliqua* Lec. *Purpurata*, a close relative of *meanyi*, has been found in the mountains of Idaho and Colorado. *Schwarzi*, the most brilliant of our species, has been secured only near Banff,

Alberta, along the margins of the streams flowing into the Bow River. It is a close relative of *piperi* and replaces it in the Rocky Mountains as *purpurata* replaces *meanyi* and *labradorica* replaces *crassicornis*. *Labradorica*, I have from several places extending from Jaspar Park, south to Banff as well as from Labrador. *Hudsonica* is a species found generally distributed along the streams coming down from the Rockies. It is common in Alberta and ranges through the Rockies to New Mexico. *Obtusa* ranges from Alberta to Colorado and *obliqua* appears to be restricted to Colorado. In the Sierras of Californica, we have five species restricted to them besides the common *eschscholtzi* found in all of the foothill streams along their western flanks. The true mountain forms are *Nebria ovipennis* Lec., a non-metallic offshoot of *columbiana*, replacing it in the higher Sierras from Mt. Tallac to Mt. Whitney; *Nebria rathvoni* Lec., a common black species which is to be found from six thousand to nine thousand feet and ranges from Nevada County to Mt. Whitney; *Nebria riversi* Van Dyke, our largest species restricted to the glacial streams close to the Lyell glacier on Mt. Lyell; *Nebria ingens* Lec., a large black species only to be found on the high mountains around Franklin Lake in Fresno County, and two small species, evidently offshoots of *sahlbergi* which have like *ingens* entirely lost their wings. These species are *Nebria lyelli* Van Dyke, found high up on Mt. Lyell and *Nebria fusiformis* Van Dyke found with *ingens*. All of our species of *Nebria* have very distinct habits which greatly influences their distribution, but that is a subject which we cannot discuss now. When we analyze the distribution of these species, we notice certain facts—first, that a limited number are maritime; second, that a few dwell along the margins of lowland streams, often becoming partly maritime in the more northern parts of their range, or mountain species in the more southern; and that the majority are truly mountain dwellers, a certain number of ours restricted to the northern coastal mountains and the more inland ranges, the Slekirks and Cascades, in a few cases also extending into the northern Rocky Mountains, another series of somewhat related species replaces the last in the Rocky Mountains, a few of the more northern even extending their range eastward over the plains to Labrador, while a third series which I believe is derived from the Cascade species, dwells in the high mountains of the southern Sierras. To me, this indicates

that the ancient glaciers and ice caps which covered the northern coastal mountains and the more inland ranges, the Selkirks and Cascades, were either in close contact or closely associated, that the glaciers and ice caps of the Rocky Mountains were very definitely separated from the preceding except in the far north, that the great ice sheets of northern Canada infringed upon the northern Rockies, and that at one time the glacial cap of the Cascades and of the Sierras was continuous but that it was broken at a very early period. The continuity of the glaciers and snow fields during the Pleistocene period would thus make possible the wide distribution which we find at the present day and the subsequent retreat and reduction of these glaciers and snow fields would then allow the various now isolated assemblies of species to gradually become modified, which is the case. Another interesting fact is that many of the distinctive groups of the mountains such as those which range from Alaska south through the Cascades and the Sierras and to a slight extent the northern Rockies, such as the *ovipennis* group including the maritime *diversa*, the Cascade *kincaidi* and *columbiana* with ovipennis of the Sierras, and the *metallica* group with the coastal *metallica*, the Cascade *piperi* and *gebleri*, the northern Rocky Mountain *schwarzi* with perhaps also *meanyi* and *purpurata* are quite closely related to similar groups found in northeastern Asia.

A third peculiar feature is that in the cool maritime province which runs along the coast to the westward of the true coastal mountains and extends from British Columbia to middle California, we have a region where there is a strong tendency for many of the species to become melanotic or at least dichromatic. In discussing the genus *Silis** of the family Cantharidæ (Lampyridæ), some years ago, I laid considerable stress upon this point. This tendency is very evident in the wet lands flanking the Pacific of both Washington and Oregon and cases of marked melanism are to be observed in many families as for instance the Carabidæ, Dascillidæ, Elateridæ, Cantharidæ, Cerambycidæ and Curculionidæ. A similar tendency along the same lines is also to be noted in the species to be found at the high levels of the Cascades and Sierras but it is less marked. These observations with regard to melanism are also in keeping with those which have been made by the ornithologists in the same region.

*"A Review of the Species of the Coleopterous Genus Silis Latr. which are found in America North of Mexico," by Edwin C. Van Dyke, Journ. N. Y. Ent. Soc., Vol. XXVI, Nos. 3-4, (September-December, 1918), pp. 161-179.

PRELIMINARY PAPER ON THE WING-VENATION OF THE HEMIPTERA (HETEROPTERA).

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INTRODUCTION AND GENERAL CONSIDERATIONS.

Although a great amount of work has been done on the wings of insects, very little attention seems to have been given to the wing-venation of the Heteroptera.

Historical.—Comstock and Needham (American Naturalist, Vol. 32, pp. 249-252, 1898) published a short discussion on the wings of the Heteroptera. They included a figure and the description of the front wing of the adult stage of a coreid, also a figure and description of the front and hind wings of a pentatomid nymph.

Comstock (The Wings of Insects, pp. 292-294, 1918). In addition to the figures and descriptions cited above, included a figure and the description of the front wing of the adult stage of an unnamed bug, an acanthiid and a mirid.

Handlirsch (Fossilen Insekten, Tafelband, Tafel VII, '06-'08) figured the tracheation of the fore and hind wings of *Lygæus* sp. and *Lygæus familiaris* (Lygæidæ); the fore and hind wings of *Syromastes* sp. (Coreidæ); the fore and hind wings of *Cyphostethus tristriatus* (Pentatomidæ); of *Brachyplatys nigriventris* (Plataspidæ); *Phyllontochila cardui* (Tingitidæ); *Salda variabilis* (Saldidæ); *Calocoris* sp. (Miridæ); *Corisa geoffroyi* (Corixidæ); the fore and hind wings of both the nymphal and adult stages of *Nepa cinerea* (Nepidæ); also the fore wings of two forms of the Paleohemiptera, *Prosbole hirsuta* and *Scytinoptera kokeni.*

Lameere (The Wing-Venation of Insects, Psyche, pp. 123-132, June-August, 1923) makes a few statements regarding the wing-venation of the Heteroptera basing his conclusions upon

*I wish to express my thanks to Professor Carl J. Drake for supplying to me from his private collection identified insects from which I was able to get excellent mounts of over 300 species, and for his constant encouragement and interest in the work. To Dr. Walter H. Wellhouse, under whose direction the work was done, I am deeply indebted for his valuable suggestions, criticisms and assistance throughout the progress of this work. Thanks are also due to Dr. H. H. Knight, other members of the Department of Zoology of Iowa State College, and graduate students, for kindly giving me nymphs of various species.

the two Paleohemipterous fossil wings discussed by Handlirsch. The same author in an article (Note sur les Insectes Houillers de Commentry, Bull. Soc. Zool. France, Vol. 42, p. 27, 1917) gives a few notes on the heteropterous wing.

Chapman (Comstock's Wings of Insects, pp. 34–35, 1918) shows figures and descriptions of the basal connections of the wing tracheæ in the nymphs of a notonectid, a corixid and *Lethocerus* (Belostonidæ).

This is apparently the present status of the wing-venation of the Heteroptera.

Purpose.—The purpose of this paper is to identify and give the characteristics of the main veins of the heteropterous wings.

The venation of the hind wing has principally been taken up since the front wing has become specialized as a protective covering for the hind wing and is consequently less useful for the study of venation. The basal one-half of the wing has become thickened so that often the veins are not easy to see, while the apical one-half is membranous and usually contains many disconnected branches. The hind wing is more generalized, is membranous and the veins are more easily seen. However, in a subsequent paper the writer plans to discuss the fore wings of the Heteroptera.

INVESTIGATIONAL.

Methods.—Dry mounts were made of both the fore and hind wings of the adult insect. One hind wing was left with the folds undisturbed and the other was unfolded.

Nymphal forms that had been preserved in various ways were used. Some were dry pinned specimens, which had been collected anytime from 1886 to the present date. The age has no effect upon the clearness of the wing tracheæ. Some had been preserved for years in Kaiserling's fixing solution, while the greater number were living specimens. The living specimens were good for getting the basal tracheal connections and also because some of the nymphs could be reared through to the adult stage when there was a doubt as to their identification. In this case all dissections were made under water and the wings were left submerged until the drawings had been made. I found this the best method for holding the air in the tracheæ. If the wings were left attached to the body and submerged, the tracheæ remained clear for several days.

Before making mounts from the dry nymphs, the insect was placed in Kaiserling's fixing solution, (a composition of acetate of potassium 200 gr., glycerine 400 cc., and water 2,000 cc.), for about fifteen minutes to relax, (the time varying with the specimen). If the wings were difficult to soften, the process was hastened by gently pressing on the wing pad with a blunt probe. When it was relaxed sufficiently the wing was removed from the body and then from the pad, (if the pad obstructed the view of the tracheæ) and was mounted in a drop of the same solution used to relax it. In this way no hurry had to be made in making the drawings for fear of the escape of air from the tracheæ. However, for very small insects it is more satisfactory to use the living nymphs. In the nymphs that were preserved in Kaiserling's solution, the tracheæ showed up very clearly and the wings were easy to dissect.

TRACHEATION OF HETEROPTEROUS WINGS AND GENERAL DISCUSSION.

The wings of the heteropterous nymphs are not folded in the wing pad. Unlike those of a large number of insects, the main tracheæ in the hind wing of Heteroptera have seldom been found to be branched. This leaves many of the veins of the adult wings without a corresponding trachea to help tell the story, and in no case was a trachea present for some of the veins such as media$_3$ and $_4$ and some of the anals. So it is only by comparison of the veins of the adult wings and of the positions that the tracheæ which are present have in the nymphal wings that the determination of some of the veins is possible.

In making the dissections of the nymphal wings, it is necessary to get the basal connection of the tracheæ in order to avoid confusion, since, if the base of the tracheæ be destroyed, some of the muscle tracheæ are likely to be confused with wing tracheæ. The possibilities of this can be seen in Figure 29.

It was found by Comstock and Needham (American Naturalist, XXXII, pp. 88-89, 1898), that the tracheæ which supply the wings with air, arise from two distinct trunks, an anterior costo-radial trunk and a posterior cubito-anal trunk and that in most insects there has been developed a transverse basal trachea which connects these two trunks.

In all of the hemipterous wings studied, I have found the transverse basal trachea to be present, and that the medial

trachea tends to migrate either toward the costo-radial group and become united with it (Figs. 34 and 42), or migrate toward the cubito-anal group of tracheæ and become united with that group (Fig. 12), or it may remain at about the center of the transverse basal trachea (Figs. 2 and 13).

The position that the tracheæ take in the development of the wing is a factor of importance in determining the course that veins have taken in the adult wings. As an example of this let us consider the development of the wing of *Leptocoris trivittatus* Say (Coreidæ) which has been carefully worked out and illustrated (Figs. 1-3).

1. Nymphal hind wing—third instar (Fig. 1).—In the third instar there are present five strong tracheæ, which are as follows: subcosta, radius, media, cubitus and anal. This is also true in the 4th and 5th nymphal stages. Subcosta and R arise from the costo-radial trachea, while M arises from the transverse basal trachea and Cu and A arise from the cubito-anal trachea. For position and direction of tracheæ, see Fig. 1. Notice in the center of the wing, the bend that the radial trachea makes toward the medial trachea.

2. Nymphal hind wing—Fourth instar.—In addition to the five strong tracheæ mentioned above, there is present the trachea of costa, which is very short and weak. It was seen only in a mount of a wing of the fourth instar nymph, just after the insect had moulted. (See Fig. 2). Also your attention is called to not only the bend that R makes toward M, as was true in the 3rd instar, but also the bend that M makes upward toward R. Also the bend that Sc makes toward the upward bend of R.

3. Nymphal hind wing—Fifth instar.—There is no trace of the costal trachea in the 5th instar. Where Sc and R were nearest together in the 4th instar, notice in Figure 3, that they are now connected by what we would call in the adult wing, a cross-vein, although it is not a vein nor a distinct trachea. Radius has lost its basal connection and has coalesced with M where they almost touched in the 4th instar. Also notice that the cubital trachea has lost its basal attachment. (Attention will be called later to the adult wing, Fig. 4).

Fig. 5 shows the tracheation of the hind wing of *Archimenus* sp. in the 4th instar. This is somewhat different from that found in *Leptocoris trivittatus* in that the cubital and anal tracheæ have united near their tips by a tracheal branch. Also back of this is a small branch of the anal trachea.

In the tracheation of the hind wing of the Lygæidæ, Handlirsch (Tafelband, Taf. VII. Fig. 1, '06-'08) interprets the five strong tracheæ as Sc, R, M, A, and A. He considers that the cubital trachea is not present in this wing and that there is a broad space between the medial trachea and the first anal

trachea; this he considers the cubital space. Consequently, he considers that the cubital vein develops without a preceding trachea in the Lygæidæ, Pentatomidæ, Acanthiidæ, and Miridæ (Taf. VII, Figs. 2, 4, 7, and 8). If we interpret the tracheæ in that way it means that the cubital vein of the majority of the heteropterous group develops without a trachea.

I disagree with him on this point, and believe that the cubital vein is formed from the first of the two trachea which he calls A for the following reasons:

1. The study of other orders of Insects such as Homoptera, Coleoptera, Lepidoptera and Neuroptera by Comstock and others has shown that the cubital trachea is present constantly while the number of anal tracheæ present is quite variable. Since that is the case it is not logical to expect such a fundamental difference in the tracheation of the heteropterous wing.
2. The trachea which I consider as Cu arises from the cubito-anal basal trachea independently and is often not closely associated with the anal trachea.
3. The broad space between the tracheæ which Handlirsch calls M and A (my, M and Cu) is in many adult wings occupied by one or two branches of veins which are not preceded by tracheæ. He calls these cubital veins, but the basal connections of these veins as shown in Figs. 44, 45, 46, and 50, indicate that these are branches of the M vein. Also compare here Figs. 50 (Nepidæ) and 51 (Gerridæ). Notice in Fig. 50 that only the base of M_{3+4} is present, while in 51 the base has lost out, but the apical ends are present.

It is interesting in this case to note that in Scudder's Tertiary Insects of North America (U. S. Geological Survey of the Territories by F. V. Hayden, Vol. XIII) on Plate 26, Figure 15, *Tagalodes inermis* (Reduviidæ) shows the same M_3 tip as is seen in the present day forms. Although the body of the insect is that of a reduviid, the wings, both fore and hind, are decidedly like those of a modern mirid.

For the tracheation of the Miridæ, see Figure 12. Notice the broad medial-three-and-four space and the similarity of the cubital and anal tracheæ to the veins in Figures 10 and 11. Also notice the remaining tracheæ in the adult wings (Fig. 10), and how closely they correspond to those of the nymphal wing (Fig. 12).

Comstock overlooked the small costal trachea which is sometimes present, consequently in the naming of the tracheæ in the pentatomid wing he called the subcostal trachea by that name. Notice in Figure 29 the broad media-three and media-four space. The dotted line in the figure shows where, if the

wing pad were cut off from the body at this region, a muscle trachea would likely be considered as a wing trachea.

For a study of the tracheation of the Reduviidæ compare the tracheæ in Figure 34 with the tracheæ and veins in Figure 35. Notice how accurately the tracheæ of the nymphal wings compare with those in the veins of the adult wing. Also notice the broad medial-three-and-four space which occurs in both wings.

In Figure 42 (a notonectid nymphal wing) it is interesting to note the basal connection of the tracheæ. The figure was inserted more to show this detail than to show the relation of the tracheæ to the veins. Since the nymph was relatively young the wings had not developed enough to show the final tracheation.

WING AREAS OF THE HIND WINGS OF THE HETEROPTERA.

The wings of the Heteroptera are divided by furrows and folds into several fairly constant and easily recognizable areas. Since several of the veins are without basal connections their identity is difficult to determine unless one considers first the areas in which these veins are located.

There are usually four distinct wing areas. The first I shall call the *costal area*. This lies between the costal margin and the median furrow and contains C, Sc, R, and M_{1+2}. This is usually the largest area present, except in certain forms with very short broad wings, such as the naucorids, where the medial area has almost been crowded out by the costal, or in the saldids where the cubital has developed to a large area, or in the gelastocorids where the anal area is unusually large.

Back of the median furrow, forming a rather triangular area between this and the medio-cubital furrow is the *medial area*, which contains M_3 and M_4 when they are present. In some families the furrows which bind the medial area are missing.

The third area I shall call the *cubital area*. This is bounded by the medio-cubital furrow and the anal fold and usually contains the cubital and first anal veins. Some exceptions will be cited later.

The *anal area* is the portion of the wing lying back of the anal fold and contains nothing but anal veins, when they are present.

I am considering only the forms I have studied. No doubt there will be a variation in many of the forms not taken up in this paper.

VEINS OF WING-AREAS.

TABLE SHOWING THE MAIN VEIN BRANCHES PRESENT IN EACH WING AREA OF THE HIND WINGS OF THE HETEROPTERA.

FAMILIES	NUMBER OF MAJOR TERMINAL VEIN BRANCHES (excluding the C margin) FOUND IN THE COSTAL AREA	NUMBER OF MAIN VEIN BRANCHES IN THE MEDIAL AREA	NUMBER OF MAIN VEIN BRANCHES IN THE CUBITAL AREA	NUMBER OF MAIN VEIN BRANCHES IN THE ANAL AREA
Coreidæ	3 to 4	None in some, though as many as 2 in others	2 to 3	1
Miridæ	2	1	2	Some have none, others have 1.
Lygæidæ	Usually 3, although the first 2 may be united for a short distance.	Some have no main branches, others have 1 or 2.	1 to 2	Some have one, others have none present.
Anthocoridæ	1 to 2	Some have none, others 1.	2	There are either no branches or only the base of 1.
Nabidæ—Long winged forms	2 to 3	Some have none, others 1.	2	Only the base of one is found.
Hebridæ	2	Furrows are missing; no veins present.	1	1
Mesoveliidæ	2	Furrows are missing; no veins present.	1	1
Phymatidæ	3	Furrows are missing; no veins.	2	1
Aradidæ	There are 2. The first of which is sub-branched.	Usually 2. Though there may be only 1 or 2 faint ones.	1 or 2	Some have none, others have 1.
Scutelleridæ	2, 3 or 4	1	2	1
Cydnidæ	3 strong, or 1 to 3 weak.	2 strong or 1 or 2 very faint.	2	Some have none, others have 1.
Pentatomidæ	There were 3 in all studied except one species, it had 2.	2 which often connect towards basal end to form a "U" or "V" shape vein.	2	1 in all forms studied except one species, which had 2.
Reduviidæ	2 or 3	None, 1 or 2.	1 or 2	1 or 2
Belostomidæ	A loop is formed by the union of the apical ends of Sc, R and M_1 and $_2$ which may give off many minor branches.	Net work of many. (M_{3+4} when present lies just back of the M-cu furrow).	2 or 3	2 showing the base of a third.

VEINS OF WING-AREAS—Continued.

Families	Number of Major Terminal Vein Branches (excluding the C Margin) Found in the Costal Area	Number of Main Vein Branches in the Medial Area	Number of Main Vein Branches in the Cubital Area	Number of Main Vein Branches in the Anal Area
Corixidæ	2 or 3	1 or 2	2	1 or 2, others show the base of a 3d.
Ochteridæ	There may be several faint branches given off from a loop which is formed by the union of Sc and R.	Several faint branches.	1, with the base and tip of a 2d. Also there may be several faint branches.	1, with base of a 2d.
Notonectidæ	0, 1 or 2 branches. In some 1 or 2—with many faint ones.	There are none, or there may be a cross-vein, or many delicate branches.	1 or 2	1 with base of a 2d, or 2 with base of a 3d.
Saldidæ	1 or 2 strong; 1 strong and 1 weak, or 2 weak branches.	0, or 1 very faint one.	2 strong, or 1 strong and 1 weak.	1 or base of 1.
Naucoridæ	There are no main branches; a loop is formed by the union of Sc, R and M_{1+2}.	No branches.	Some have 2, others show only the base of 2.	1, with the base of a 2d.
Gelastocoridæ	The Sc, R and M veins unite at their tips and give off many delicate branches.	Many minor branches.	There are 2 main branches with many minor branches given off from 1st vein.	2 main branches with the base of a 3d.
Nepidæ	1	0	2 coalesced.	2
Gerridæ	3, one of which is split by the m-cu furrow.	2, one of which is split by the M furrow, also one crosses over from the Cu area.	1	1
Veliidæ	2, which almost form a loop.	There are no main branches; one, however, crosses from the Cu. area.	1	1 faint one.
Piesmidæ	2, the first of which is branched.	1	2, no anal fold.	No anal area.
Tingitidæ	2 or 3; when 3, C has left costal margin.	None, 1 or 2.	No anal fold; there is a base of one, or 1 or 2 branches.	No anal area.

GENERAL CHARACTERISTICS OF MAIN VEINS IN THE HIND WINGS OF THE HETEROPTERA AS A WHOLE

Costa.—In the Coreidæ, Miridæ, Lygaeidæ, Anthocoridæ, Nabidæ, Phymatidæ, some of the Cydnidæ, Saldidæ, Nepidæ and Piesmidæ, costa lies along the costal margin. In the Hebridæ, Mesoveliidæ, Reduviidæ, Belostomidæ, Corixidæ, Ochteridæ, Notonectidæ, Naucoridæ and Gerridæ, costa follows the costal margin until subcosta turns inward from the margin. In the Aradidæ and Gelastocoridæ, C and Sc leave the costal margin at the base of the wing and neither ever return to it. In the Scutelleridæ, some of the Cydnidæ, Pentatomidæ and Veliidæ, C and Sc. leave the costal margin at the base of the wing, but C returns to the margin about mid-way of the wing's length. In the Tingitidæ the base of costa is not seen but at about mid-way of the wing's length, a vein (C) extends downward from the membranous margin of the wing and then extends almost parallel to the margin.

Subcosta.—The Phymatidæ is the only family studied which shows Sc to be branched. (See Fig. 23).

In all of the families studies when Sc leaves the costal margin, or at about where it leaves the margin in the coreid wing, if it is not on the costal margin, it may follow one of several courses: (1) It extends downward and touches R, then ends blindly in the loop made by the union, as in the Naucoridæ, or it may give off many branches from this loop as in some of the Notonectidæ, the Belostomidæ, Ochteridæ and Gelastocoridæ. (2) It fuses after touching with R and they continue as one vein the rest of their length, as in the Miridæ, Anthocoridæ, Hebridæ, Mesoveliidæ, some of the Cydnidæ, some of the Notonectidæ, and the Reduviidæ, Nepidæ, Geriidæ, Veliidæ and Tingitidæ. (3) Radius coalesces with Sc for part of its length and then separates, as it does in two species of the Lygaeidæ, some of the Nabidæ, the Aradidæ and some of the Piesmidæ. (4) They (Sc and R) may merely touch each other then separate and remain as separate veins, as in the coreid wings, all of the Lygaeidæ studied, except the two forms referred to above, and some of the Cydnidæ and Pentatomidæ.

Radius.—In the Scutelleridæ (Fig. 25) where R divides into R_1 and R_s, the first branch bends over and merely touches Sc, the second branch goes with M_{1+2}. In some of the Coreidæ, and Aradidæ R may divide into R_1 and R_s but not until after R has touched or coalesced for a short distance with Sc. When R does not divide into R_1 and R_s before it bends upward to touch or unite with Sc, it always unites with M_{1+2} either (1) by a cross-vein, or (2) by coalescing with it for a short distance before bending upward to meet Sc, or coalesces with it from its base, then bends upward to unite with Sc. These are the cases in all the families taken up in this paper.

Media.—Media $_{1+2}$ is always an unbranched vein except in the Cydnidæ and Pentatomidæ, (See Figs. 26, 30, 31). In these two families the basal connection of M_2 and M_1 is lost, but a portion of M_2, before uniting with M_1 near its tip, is present. This is a very characteristic feature of these families. The vein M_{1+2} usually bends upward at about

its center, when uniting with R. The presence of M_3 and M_4 is not always constant, even in the same families. These veins were discussed in the first part of the paper.

Cubitus.—The basal connection of the cubital vein is not always constant in the same family. Sometimes it is united at the base with 1st A, sometimes they have separate basal attachments, or it may have lost its basal attachment, or it may have lost out entirely, as is true in the case of the Hebridæ and Mesoveliidæ studied. Cubitus is never branched. Sometimes Cu and 1st A have united into one vein as in the Nepidæ.

Anals.—The anal veins vary considerably. Sometimes only the basal attachment of one vein is present as is true of some of the Tingitidæ. Sometimes only one strong vein is present, as is true in some of the Miridæ, Scutelleridæ, and Tingitidæ. But usually there are two strong anal veins in the hemipterous hind wings. However, in the Nepidæ, Gelastocoridæ and Belostomidæ and some of the Corixidæ there are three, and in some of the Corixidæ and Gelastocoridæ there is a trace of a fourth.

Cross-veins.—Cross-veins are seldom seen in the heteropterous hind wings. However, one species of the Anthocoridæ studied, the long-winged Nabidæ, Reduviidæ, some of the Notonectidæ and the Saldidae radius does not touch with media in its central dip to coalesce with it, as is true in the other forms studied, but instead forms a short cross-vein, r-m. (See Figs. 17, 18, 35, 36, 37, 43, 45, and 46). Also in some of the Corixidæ and Ochteridæ (Figs. 40, 41), there is a very faint cross-vein which lies between M_{3+4} or M_4 and Cu. This is the medio-cubital cross-vein. It is broken by the medio-cubital furrow. Then in some of the Notonectidæ (Fig. 43) there is a faint cross-vein. In this species the M_3 and M_4 veins are not present. These are the only forms in which I have found distinct cross-veins.

DISCUSSION OF CERTAIN FAMILIES.

Coreidæ.—(Figs. 4 and 6). In all of the coreids studied C and Sc are similar to those shown in Figs. 4 and 6.

Radius is usually an unbranched vein, the base of which has lost out. After the apical end separates from M and turns upward and touches Sc, it then bends downward and divides into R_1 and $R_{2,}$ or runs as a single vein the rest of its length. In some insects, as *Leptocoris trivittatus*, I found examples of both types just referred to in different individuals of the same species.

Media 1 and 2 remain the same throughout the family as is shown in Figs. 4 and 6. M_3 and M_4 never unite with M_{1+2}. Sometimes they are united toward their basal ends and sometimes they are both missing. When present they always lie in the medial area.

In the forms studied, Cu is always a single vein, the base of which is often missing, however, in *Catorhintha mendica* Stal, the base and the trachea are both present.

There are two anal veins and often the first one is branched as indicated in Figs. 4 and 6.

I wish to call your attention here to the tracheation and venation of the fore-wing of *Leptocoris trivittatus*, Figs. 7 and 8. Notice in Fig. 8 (the adult wing) how clearly the trachea were preserved, and how accurately the veins correspond to the tracheæ of the nymphal wing.

Miridæ.—(Figs. 9-14). Costa in the mirid wings is the same as in the coreids. Subcosta and radius remain the same as in the coreids, except that after R bends upward toward Sc, they unite and continue as one vein the remainder of their length.

For Media $_{1+2}$, see Figs. 9, 10 and 11. M_3 and M_4 seem to have united and lie at about the center of the medial area.

Cubitus and the first anal vein are often united at their bases, though more often Cu has lost its basal attachment. The anal vein back of the anal furrow is similar to that of the coreid wings.

For the venation of the fore-wing see Figs. 13 and 14. Notice how the veins of the chitinized half of the wing have formed around the tracheæ which still remain almost identical to those found in the nymphal wing. In the adult wing of this form, the tracheæ are remarkably clear and easily seen.

Lygaeidæ.—(Figs. 15 and 16). In the lygaeid wings, C is practically the same as in the coreid wings. The same is true for Sc, except in a few cases after it touches with R, it bends upward again and unites with C, (Fig. 16). You will notice that R lies closer to Sc at its basal end and in *Myodocha serripes* Oliv. and *Lygaeus bicrucis* Say, it branches away from Sc. The apical end of R is never seen to be branched as was true in some of the coreid wings.

The cubital vein in the lygaeids is very similar to that found in the mirids. In certain small forms, as *Cymus discors* Horv., it has practically lost out. Also all of 1st A except the base, and the anal back of the anal fold is often completely missing.

Anthocoridæ.—(Fig. 17). For the characteristic position and direction of C and Sc, see Fig. 17. In *Lyctocoris campestris* (Fabr.) (Fig. 17), R does not quite touch M and the cross-vein r-m is formed, though usually, R coalesces for a short distance with M, as in Figs. 9 and 11, also Sc and R are united at their apical ends as they are in the mirid wings. For M_{1+2} see Figures 17. Sometimes only one vein is left of M_3 and M_4 as in Fig 17 sometimes both are missing. The cubital and anal veins are very similar to those shown in Fig. 17.

Nabidæ.—(Figs. 18, 19 and 20). For the characteristics of the wings of the long-winged forms studied, see Fig. 18. In one form studied, *Nabis subcoleoptratus* Kirby, radius and subcosta are not coalesced at their apical ends, but remain separate as in Fig. 15 (Lygaeidæ). The cross-vein r-m is a very striking character of the long-winged nabids. In *Nabis subcoleoptratus* Kirby there is a trace of M_4. Though most often both M_3 and M_4 are missing.

Hebridæ and *Mesoveliidæ.*—(Figs. 21 and 22). You will notice that the venation of these two forms is very similar and that the veins present are very weak except the basal one-half of both C+Sc and 1st A. Notice that the cubital vein has lost out.

Phymatidæ.—(See Fig. 23). The most distinctive feature of the phymatid wing is the fact that where Sc leaves the costal margin Sc_1 separates from Sc_2 and runs almost parallel with the costal margin for the rest of its length. Another characteristic feature of the phymatid wing is that Cu and 1st A are almost parallel to each other.

Aradidæ.—(Figure 24). For C, Sc, R and M_{1+2} see Fig. 24. M_3 and M_4 are not constant. One or both may lose out.

In most cases Cu, when present, is a weak vein, and 1st A is only a chitinized streak for about one-half its length. Third anal is a strong vein which lies very close to the outer anal area.

Scutelleridæ.—(Fig. 25). Notice here that C, Sc, and R have coalesced and have moved in from the costal margin, leaving a broad membranous space between the first vein and the margin of the wing. However, near the middle of the length of the vein, costa branches from the main vein and is seen for a short distance as a thickening along the margin of the wing. The costal trachea can be seen at the base of the vein C+Sc+R. Figures 25, 31 and 35 show more clearly where costa branches from subcosta.

The basal attachment of R is not clear, however, the base of the radial trachea is clearly seen in the vein C+Sc+R. After coalescing with M_{1+2} radius separates from it again and extends back towards Sc, branching here into R_1 and R_s. Radius one is all that coalesces with Sc, for R_s bends back and unites with M_{1+2}.

For media, see Fig. 25. Media-four was not present in any of the forms studied.

Cubitus and the anal veins are very similar to those shown in Fig. 25.

Cydnidæ.—(Figs. 26, 27, 28). In the Cydnidæ C and Sc are very similar to those found in the scutellerid wing. From the base of the wing, C, Sc, and R may move in from the wing margin, except when C separates from the main vein and extends for a short distance along the margin of the wing; however, in some forms (Fig. 28) they may not move in for about one-half the length of the wing.

Often the base of R is not seen after it unites with M, as is true in *Aethus conformis* (Uhl.), (Fig. 27), *Cyrtomenus mirabilis* (Perty), *Thyreocoris unicolor* P. B., *Thyreocoris lateralis* (Fabr.) and *Amnestus pusillus* Uhl., (Fig. 28). In *Sehirus cinctus* (P. B.) (Fig. 26) a portion of the base of R, after uniting with M, can easily be seen. There seems to be no evidence that R branches, as it does in the scutellerid wings, but that the entire vein migrates back towards Sc and coalesces with it.

Media-one and M_2 are not connected at their base. Media-two apparently branches from the same place that M_3 does. They have lost their basal attachment, but remain very close together for some distance, being separated only by the median furrow. Media-two separates from M_3 near to its apical end, then extends upward and unites with M_1. This is a thing not seen in any of the other families studied except in the pentatomids. Media-four may or may not be present.

For cubitus and the anal veins see Figs. 26, 27 and 28.*

*On certain wing-veins of the Cydnidæ there are located definite file-like structures; the function of which will be taken up in a subsequent paper.

Pentatomidæ.—(Figs. 29, 30, 31, 32, 33). Costa and subcosta are very similar to those found in the scutellerid wings. Costa, subcosta and sometimes radius are united at their bases into a strong vein as is shown in Figs. 30 and 31. In this strong vein in *Chlorochroa sayi* Stal, there are three strong tracheæ present, the lowest of which stops abruptly where the tip of the radial vein is seen after R unites with M_{1+2}. The other two tracheæ extend on to where C separates from Sc. Also in *Brochymena carolinensis* (Westw.) a clear trachea is seen in the radial vein from the tip of it just before it unites with M until it touches with Sc. There seems to be no evidence in any of the forms studied that radius divides into R_1 and R_s.

In the same species referred to above there is seen a trachea for M_{1+2} which extends in this vein from a short distance before R unites with it until beyond where R separates from it again.

Very characteristic veins in the pentatomid wings are M_3 and M_4, which are almost always joined to form a U or V-shaped vein. (See Figs. 30 and 31).

Sometimes Cu and 1st A are united at their bases, sometimes they both have distinctly separate bases and sometimes Cu has lost its base. The anal vein in the anal area is similar to that of the coreid wings.

For the fore wing of a pentatomid see Fig. 33. Fig. 32 shows the tracheation of the wing of a nymph of the same genus.

Reduviidæ.—(Figs. 34, 35, 36, 37). In the reduviids C follows along with Sc until they bend away from the costal margin, then C branches away from Sc and continues as a single vein for the rest of its length. The base of C is never clearly seen, however, in *Stenopoda culiciformis* (Fabr.) the trachea is clearly seen branching away from the vein Sc. and it is enclosed within a faint vein similar to the one shown in Fig. 35. In *Narvesus carolinensis* Stal, the costal trachea is not seen at this place, but the subcostal trachea is clearly seen following with the subcostal vein. Also the basal tracheæ of M, Cu and 1st A are seen to correspond with those shown in Fig. 34.

Radius does not quite touch with media in its downward bend, but instead a strong cross-vein r-m is formed. In the adult wing of *Melanolestes picipes* (H. S.) and *Zelus bilobus* Say a strong trachea for this vein is seen to follow in the downward bend towards M and to continue with it until after it unites with Sc.

For the characteristics of the median veins, see Figs. 35, 36 and 37.

Cubitus and 1st A are very similar to those in the phymatid wings. Usually the base of 1st A is stronger than that of Cu, but the apical end of Cu is more likely to stay longer than that of the first anal vein. In all of the forms studied there are only two anal veins present. In *Oncerotrachelus acuminatus* (Say) the base of 1st A is split by the anal fold.

Belostomidæ.—(Figs. 38, 39). Costa, subcosta, radius and media, in the belostomid wings are very similar to those shown in Figs. 38 and 39. Media-three and media-four, when present, have united and lie just back of the medio-cubital furrow.

Cubitus and 1st A are similar to those shown in Figs. 38 and 39. However, in *Abedus dilatatus* (Say) 1st A is a very short vein, extending only to where Cu and it separate in Fig. 38.

In all of the forms studied there were two strong anal veins back of the anal fold.

Corixidæ.—(Fig. 40). Costa branches from Sc but unites with it again as is shown in Fig. 40; however, this branch is not always present though it usually is. Subcosta, radius and media are very similar to those shown in Fig. 40. Notice between M_{1+2} and M_{3+4} the median cross-vein, which is broken by the median furrow, also notice the cross-vein m-cu, which lies between M_{3+4} and Cu. This one is broken by the medio-cubital furrow. In all of the forms studied the connection between Cu and 1st A was very similar to that shown in Fig. 40. This is also true of the anals back of the anal fold.

Ochteridæ.—(Fig. 41). For the venation of the ochterid wing, see Fig. 41.

Notonectidæ.—(Figs. 43 and 44). There is a considerable variation in the venation of the noctonectid wings, as is shown in Figs. 43 and 44. *Buenoa margaritacea* Bueno (Fig. 44) is the only form studied in which the venation is of the type figured. Notice here the base of M_3 and M_4 coming away from M_{1+2}; also notice that the first anal vein has moved back of the anal fold into the anal area and that there are now two anal veins in the anal region while before when 1st A has been in front of the fold there has only been one anal vein in the anal region. In all of the other forms studied the venation was very similar to that shown in Fig. 43, except in the case of *Notonecta insulata* Kirby. Here when R extends downward in the direction of media it completely touches with it so that a cross-vein is not formed. Radius then bends upward and unites with the vein C+Sc, as in Fig. 43, after coalescing they continue as one vein for a short distance and then branch. Media-one-plus-two, after separating from R, may give off many faint branches, some of which cross the median furrow and extend into the medial area, towards the wing's edge beyond the medio-cubital cross-vein, which is present as in Fig. 43. The cubital and anal veins are very similar to those shown in Fig. 43, only the apical end of Cu is not connected with its base.

In *Notonecta mexicana* Am. & Serv. radius and media touch, therefore, the cross-vein r-m is not formed. After R bends upward and unites with Sc, they do not separate as they do in *Notonecta insulata* Kirby and there are no branches given off from media, as was true in the species just mentioned. The tip of Cu is not connected with its base, but is similar to the one shown in Fig. 43.

Saldidæ.—(Figs. 45, 46). The Figures just referred to show very clearly the types of venation found in the hind wings of the saldids. The base of R is clearly seen and the cross-vein r-m is very characteristic of these wings. Notice the presence of the base of M_3 and M_4 in the two forms figured; however, the tips of the veins are seldom seen. When present they are as a single chitinized streak.

Cubitus is often a very weak vein, and the first anal vein is always found to lie in the cubital area.

Naucoridæ.—(Figs. 47 and 48). For a typical venation of the naucorid wings, see the Figures just referred to.

Galastocoridæ.—(See Fig. 49).

Nepidæ.—(Fig. 50). The venation of the other nepid wings studied was almost identical to that type shown in *Ranata buenoi* Hung. (Fig. 50). Notice here that Cu and 1st A lie side by side, also notice the unusual character that the anal fold has two sub-folds and that back of the second anal vein is an anal furrow.

Gerridæ.—(Fig. 51). The venation shown in Fig. 51 is typical of the hind wings of the other gerrids studied. Notice that M_3 is split by the median furrow. Media-four is not always present and the tip end of 1st A is not always seen to branch from Cu as is shown in Fig. 51.

Veliidæ.—(Fig. 52). In *Rhagovelia obesa* Uhl. C, Sc, R and M are almost identical to those shown in *Velia brachialis* Stal. (Fig. 52). However, 1st A branches from Cu just a little in front of where they bend away from the anal fold.

Piesmidæ.—(See Fig. 53). Notice the absence of the anal area.

Tingitidæ.—(Figs. 54, 55, 56). In the tingids there is an interesting variation. The veins may be arranged in any of the three ways referred to above, or in some cases as *Dichocysta pictipes* Champ. M_3 and M_4 may both be present but not connected toward their basal end, as they are in *Teleonemia belfragei* Stal, also in this form Cu and A are united at their bases. Notice that the anal area is missing. This is true of the tingids as well as of the piesmids.

The venation of the majority of the forms studied was more like that of *Corythucha pallipes* Pars. (Fig. 55) where M_3 and M_4 have coalesced into one vein and Cu and 1st A lie very close to the wing's margin. However, in a few of the forms as *Galeatus peckhami* (Ashm.) the venation was more like that found in *Corythucha marmorata* (Uhl) (Fig. 56). Notice here that the medio-cubital furrow has moved back so that the cubital area is almost crowded out, as the anal has been.

SUMMARY.

1. It has been observed that the veins of the adult heteropterous hind wing, to a large extent, follow the path of their preceding tracheæ, and that a knowledge of tracheation is essential in determining certain veins.

2. The wing is divided into several well defined wing areas, which are characteristic of the heteropterous wings.

3. The wing veins have certain characteristics which are as follows:

In the hind wings costa usually lies along the costal margin, although it is not always marginal.

Subcosta usually follows the costal vein for about one-half of its length, then bends toward R usually fusing with it, although they may separate after touching.

The base of R is seldom seen although when present it comes away from, or lies close to Sc then it extends toward M_{1+2} unites with it, either by coalescing for a short distance or by a cross-vein, then turns back in the direction of Sc and touches, or coalesces with it. Radius-one may or may not at this place separate from R_s. A cross-vein r-m may be formed if R does not quite touch with M in the downward bend.

Media-one-plus-two is usually an unbranched vein. Costa, Sc, R and M_{1+2} lie within the costal area. Media-three and media-four may or may not be present; when present only the apical ends or the base were seen. These lie within the medial area.

Cubitus when present is a single vein lying within the cubital area. Often it is united at its base with the first anal vein.

There are usually two anal veins. The first of which usually lies above the anal fold within the cubital area; the second, lies back of the anal fold and within the anal area.

EXPLANATION OF PLATES.

Abbreviations Used

(Basal connections of tracheæ: Chapman's Terminology).

c-r, costo-radial trachea.
cu-a, cubito-anal trachea.
d. lt, dorsal longitudinal trachea.
l 2, mesothoracic leg trachea.
l 3, metathoracic leg trachea.
mt, muscle trachea.
ps, posterior stem of the leg trachea.
sp 1, mesothoracic spiracle.
sp 2, metathoracic spiracle.
sp 3, first abdominal spiracle.
tb, transverse basal trachea.
---------, tracheæ seen in adult wings.

Plate I.

Fig. 1. Leptocoris trivittatus (Nymph-third instar).
Fig. 2. Leptocoris trivittatus (Nymph-fourth instar just after moulting).
Fig. 3. Leptocoris trivittatus (Nymph-fifth instar).
Fig. 4. Leptocoris trivittatus (Adult).
Fig. 5. Archimenus sp. (Nymph-fourth instar).
Fig. 6. Archimenus calcarator (Adult).
Fig. 7. Leptocoris trivittatus (Nymph-fifth instar, fore wing).
Fig. 8. Leptocoris trivittatus (Adult-fore wing).
Fig. 9. Opistheuria clandestina (Adult).
Fig. 10. Lopidæ sp. (Adult).
Fig. 11. Labotas hirtus (Adult).
Fig. 12. Miris dolabratus (Nymph-late instar).

PLATE II.

Fig. 13. Miris dolabratus (Nymph-late instar, fore wing).
Fig. 14. Miris dolabratus (Adult-fore wing).
Fig. 15. Lygaeus bicrucis (Adult).
Fig. 16. Myodocha serripes (Adult).
Fig. 17. Lyctocoris campestris (Adult).
Fig. 18. Nabis roseipennis (Adult-long wing).
Fig. 19. Nabis rufusculus (Adult-short wing).
Fig. 20. Nabis roseipennis (Adult-short wing).
Fig. 21. Merrigata brunnea (Adult).
Fig. 22. Mesovelia mulsanti (Adult).
Fig. 23. Phymata erosa (Adult).
Fig. 24. Aradus crenatus (Adult).

PLATE III.

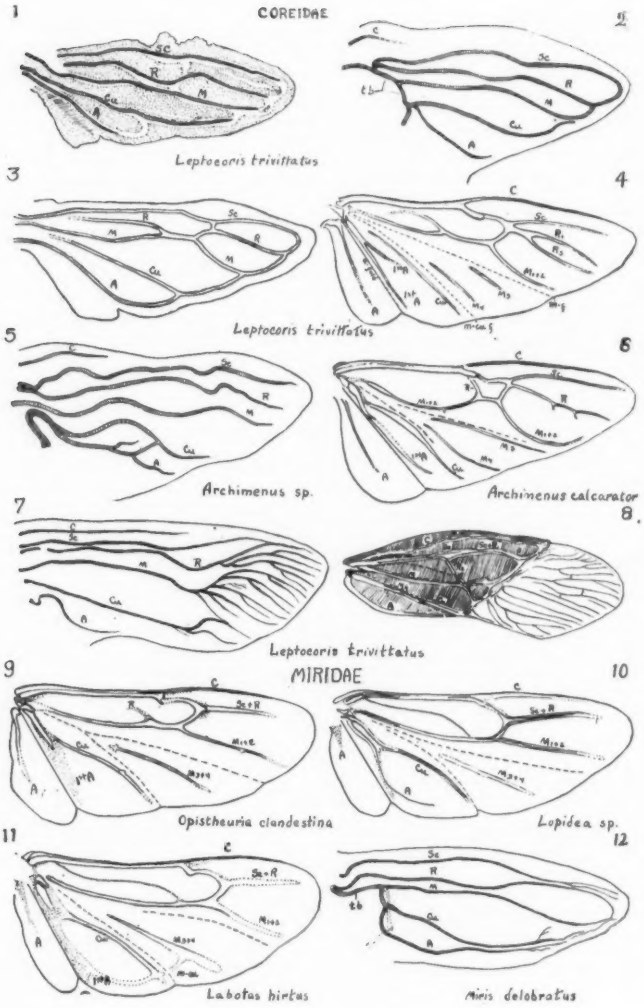
Fig. 25. Tetyra bipunctata (Adult).
Fig. 26. Sehirus cinctus (Adult).
Fig. 27. Aethus conformis (Adult).
Fig. 28. Amnestus pusillus (Adult).
Fig. 29. Apateticus sp. (Nymph, last instar).
Fig. 30. Brochymena cariosa (Adult).
Fig. 31. Alcaeorrhynchus grandis (Adult).
Fig. 32. Apateticus sp. (Nymph-fore wing, last instar).
Fig. 33. Apateticus sp. (Adult-fore wing).
Fig. 34. Reduvius personatus (Nymph-last instar).
Fig. 35. Reduvius personatus (Adult).

PLATE IV.

Fig. 36. Oncerotrachelus acuminatus (Adult).
Fig. 37. Pygolampis pectoralis (Adult).
Fig. 38. Belostoma flumineun (Adult).
Fig. 39. Lethocerus uhleri (Adult).
Fig. 40. Ramphocorixa accumilata (Adult).
Fig. 41. Ochterus perbosci (Adult).
Fig. 42. A Notonectid (Young nymph—fore and hind wing).
Fig. 43. Notonecta undulata (Adult).
Fig. 44. Buenoa margaritacea (Adult).

PLATE V.

Fig. 45. Salda coriacea (Adult).
Fig. 46. Saldula separata (Adult).
Fig. 47. Pelocoris femoratus (Adult).
Fig. 48. Pelocoris carolinensis (Adult).
Fig. 49. Gelastocoris sp. (Adult).
Fig. 50. Ranata buenoi (Adult).
Fig. 51. Gerris canaliculatus (Adult).
Fig. 52. Velia brachialis (Adult).
Fig. 53. Piesma cinerea (Adult).
Fig. 54. Teleonemia belfragei (Adult).
Fig. 55. Corythucha pallipes (Adult).
Fig. 56. Corythucha marmorata (Adult).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COREIDAE
2
Leptocoris trivittatus
3
4
Leptocoris trivittatus
5
6
Archimenus sp.
Archimenus calcarator
7
8.
Leptocoris trivittatus
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MIRIDAE
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Opistheuria clandestina
Lopidea sp.
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Labotas hirtus
Ainis delobratus

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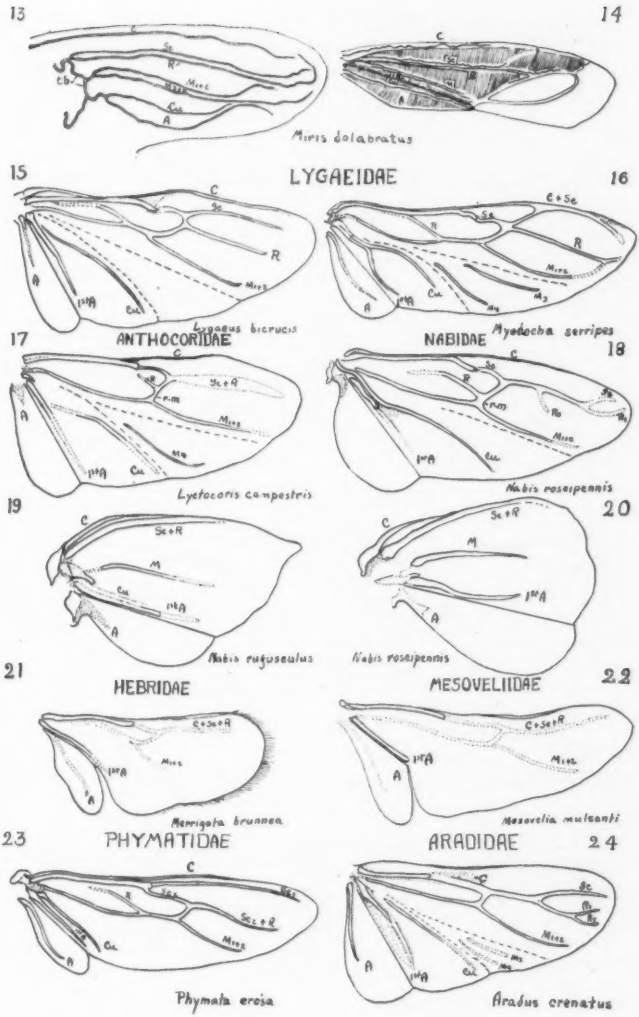
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Miris dolabratus
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LYGAEIDAE
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Lygaeus bicrucis
Myodocha serripes
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ANTHOCORIDAE
NABIDAE
18
Lyctocoris campestris
Nabis roseipennis
19
20
Nabis rufusculus
Nabis roseipennis
21
HEBRIDAE
MESOVELIIDAE
22
Merragata brunnea
Mesovelia mulsanti
23
PHYMATIDAE
ARADIDAE
24
Phymata erosa
Aradus crenatus

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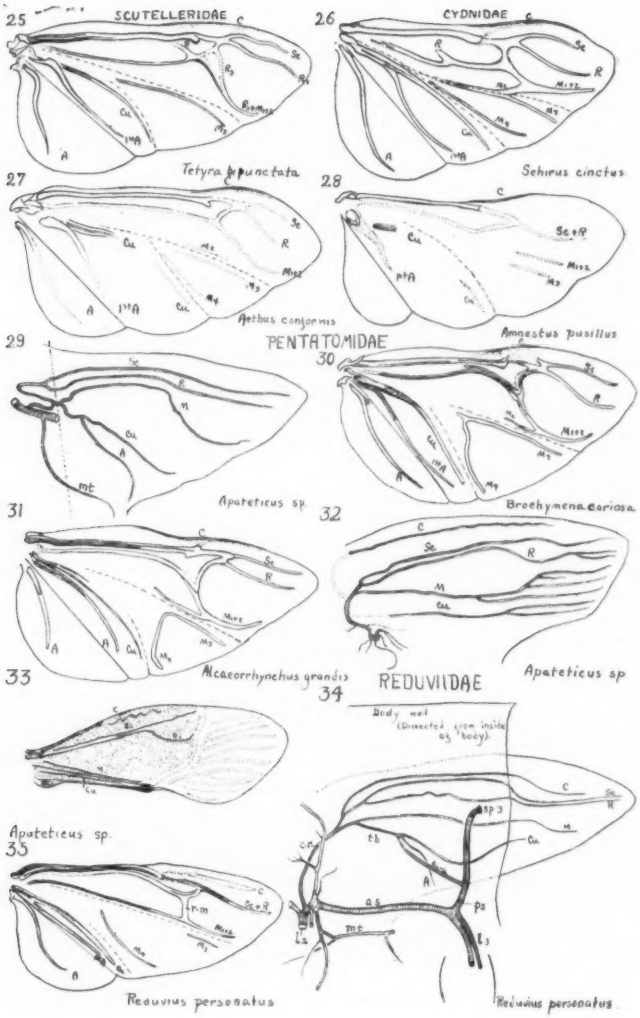
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SCUTELLERIDAE
Tetyra bipunctata
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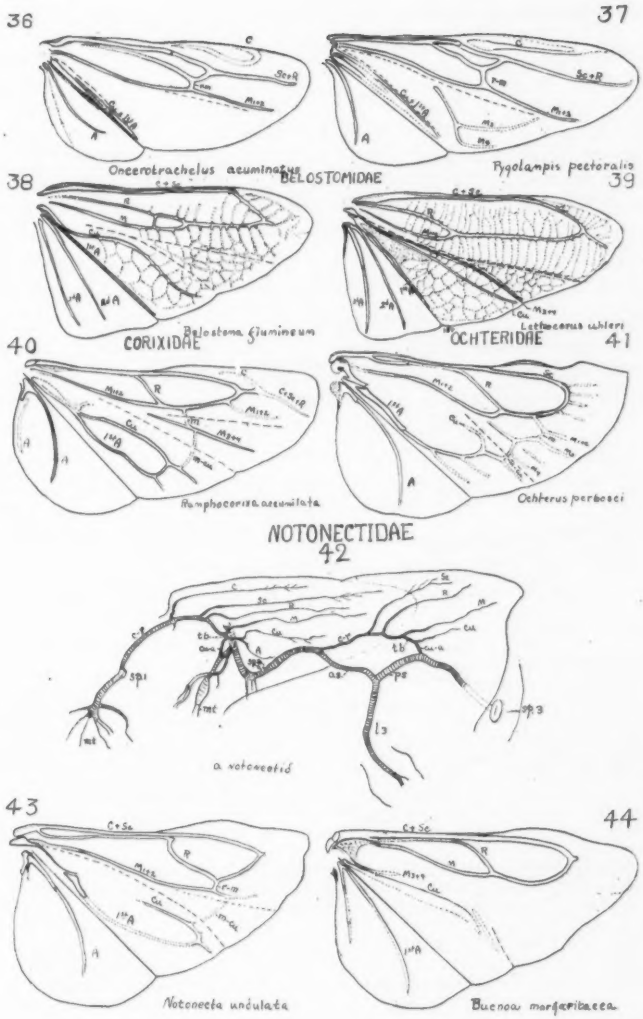
CYDNIDAE
Sehirus cinctus
27
Aethus consormis
28
Amnestus pusillus
PENTATOMIDAE
29
Apateticus sp.
30
Brochymena cariosa
31
Alcaeorrhynchus grandis
32
Apateticus sp
33
REDUVIIDAE
34
Body wall
(Directed from inside of body)
Apateticus sp.
35
Reduvius personatus
Reduvius personatus

Sara Hoke.


36
37
Oncerotrachelus acuminatus
BELOSTOMIDAE
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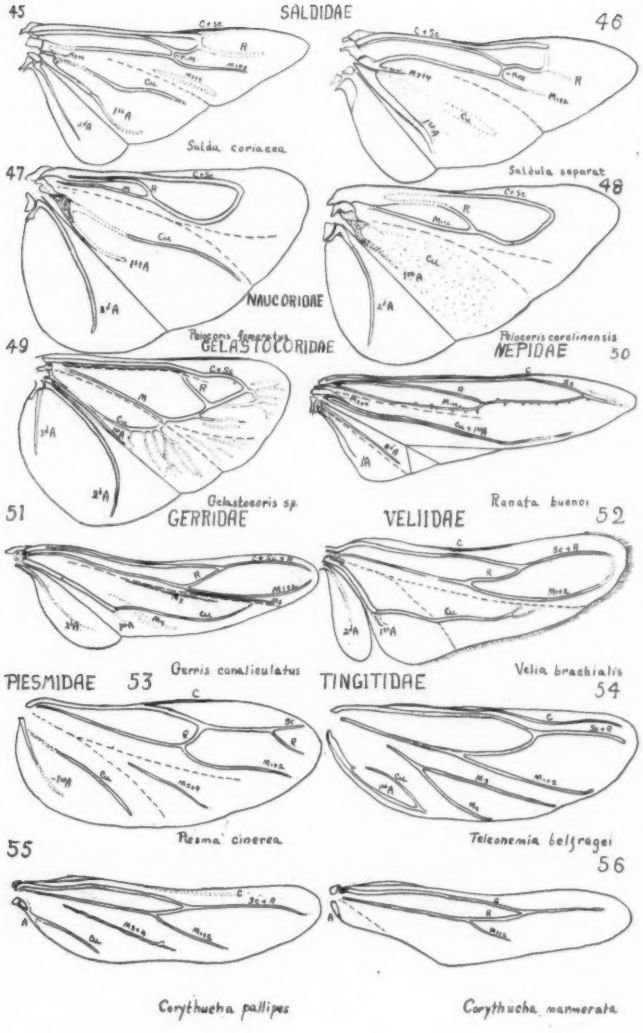
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Sara Hoke.

THE GENUS THINOPHILUS IN NORTH AMERICA.

(Dolichopodidæ, Diptera).

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This paper contains tables of males and females of the species of the genus Thinophilus, found in North America, together with descriptions of eleven new species of which we have males and two species of which we have only the female.

The genus contains species from 2–7 mm. long, they have the face wide in both sexes, the palpi large, usually very large, antennæ short, formed alike in both sexes, with the third joint about as long as wide and with a dorsal arista. There are no acrostichal bristles on the thorax, the lower orbital cilia are scarcely separated from the rather abundant beard. The species live near water, many being found on the seashore.

I am greatly indebted to Dr. J. M. Aldrich for the loan of the United States National Museum material; to Mr. Edward P. Van Duzee, for that of the California Academy of Sciences, and to Mr. Curran, for the loan of an interesting species taken in British Columbia.

TABLE OF MALES OF NORTH AMERICAN SPECIES.

1. Wings with a clouded spot on the cross-vein and on the middle of the last section of fourth vein....2
   Wings uniform in color, without spots on the veins....6
2. Femora and tibiæ wholly yellow....3
   Femora black, at least at base or on upper edge of posterior pair....4
3. Fore coxæ and legs with black hair; fore tibiæ with a row of spines on anterior surface, (Wyoming)....*pectinifer* Wheeler
   Fore coxæ and all femora with only pale hairs, tibiæ with small black bristles, (Lower California; Mexico)....*mexicanus* new species
4. Fore and middle tarsi ornamented and with long hairs (Manitoba, Nevada, Utah)....*spinipes* new species
   Fore and middle tarsi plain, and without long hair....5
5. Tarsi becoming blackish on apical half, the black not sharply defined; wings milky white, the spots on the veins very conspicuous, (Florida; Maryland). *bimaculata* Johnson
   Last four joints of fore and middle tarsi black; spots on the wings not very conspicuous, (Mexico)....*Mexicanus* new species
6. All tibiæ brown; length, 6 mm. (Florida; Louisiana)....*frontalis* Van Duzee
   All tibiæ wholly yellow, or posterior pair a little blackened at base....7
7. One or more pairs of femora more or less infuscated; fore tarsi widened, at least the fifth joint widened a little....8
   All femora wholly yellow; fore tarsi not widened....10

8. Fore tarsi wholly black, first joint much widened, fringed on the edges, (Colorado).....*latimanus* new species
Fore tarsi partly yellow, only the last joint a little widened.....9
9. Fore tarsi yellow at base and below, blackened above from second joint; hind femora with long black hairs below; hind tibiæ blackish at base, ciliated below with short hairs, (Lower California; Mexico), *longiventris* new species
Fore tarsi almost wholly yellow; fore femora slightly infuscated; both middle and hind femora ciliated with black hairs below, which are scarcely as long as their width; hind tibiæ not ciliated, (Florida)..*thalassimus* new species
10. Fore coxæ wholly yellow, at most only slightly darkened at base.....11
Fore coxæ blackish, at least distinctly blackened at base on outer surface...16
11. Hind femora, usually the middle ones also, ciliated below with hairs or bristles.....12
Middle and hind femora with only the usual short hair.....14
12. Middle and hind femora with long pale hairs below on basal portion, these are very delicate and scarcely as long as width of femora, (Missouri), *delicatus* new species
Hind femora with black hairs or bristles below.....13
13. Posterior femora ciliated on apical two-thirds with hairs which are not as long as their thickness; length, 2 mm. (Texas)....*nigripilosus* new species
Middle and hind femora with long bristly hairs; length, 4–5 mm.; fore femora with short bristles or spines below, (Florida; Texas)..*armiger* new species
14. Pollen of the thorax very coarse and yellowish; palpi rather small, (Lower California).....*depressus* new species
Pollen of the thorax rather fine, white or grayish; palpi large.....15
15. First joint of middle tarsi as 26, remaining joints taken together as 29; wing veins and costa wholly yellow, (Kansas).....*cantities* new species
First joint of middle tarsi as 28, of remaining joints taken together as 25; costa and the wing veins partly brown, (New Mexico), *magnipalpus* new species
16. Wing veins wholly yellow; palpi silvery white, (Kansas), *canities* new species
Wing veins largely blackish, sometimes a little yellow at root of wing.....17
17. Face opaque with ochre yellow pollen, (Massachusetts, New York, Florida, Missouri).....*ochrifacies* VanDuzee
Pollen of the face grayish brown, nearly concealing the ground color, (Texas), *nigripilosus* new species
Face with more or less white pollen.....18
18. Face nearly opaque with white pollen; rather large species, (Florida, Massachusetts.....*prasinus* Johnson
Face with thin white pollen, the ground color showing through.....19
19. Small species; fore coxæ largely yellow, (Massachusetts), *viridifacies* VanDuzee
Large species; fore coxæ almost wholly infuscated, (Florida), *thalassimus* new species

TABLE OF FEMALES

1. Fore coxæ with black hair.....2
Hairs of fore coxæ wholly or mostly white or yellow.....5
2. Femora black with yellow tips.....3
Femora yellow, their tips may be infuscated.....4
3. Beard composed of very stiff, golden yellow hairs; face below the suture about one-fourth as long as wide, (Utah).....*rufibarbis* new species
Beard composed of rather slender, but long hairs, of a grayish white color, tinged with yellow; lower portion of face one-half as long as wide, (Nevada; Utah).....*spinipes* new species
4. Tips of posterior femora above and whole of posterior tibiæ blackish; middle tibiæ more or less brownish, (Florida; Louisiana).....*frontalis* VanDuzee
Femora and tibiæ wholly yellow, except sometimes the extreme tip of anterior pair, (Wyoming; California).....*pectinifer* Wheeler

5. Fore coxæ wholly yellow.....6
Fore coxæ black, or more or less infuscated at base.....7
6. Hind margin of fourth abdominal segment with long bristles, (New Mexico), *magnipalpus* new species
Posterior margin of fourth abdominal segment with only short hair, (Kansas), *canities* new species
7. Wings with distinct brown spots on the cross-vein and middle of last section of fourth vein; arista white or pale yellow.....8
Wings without such spots, at most the cross-vein slightly bordered with brown.....10
8. Last tarsal joints a little widened, (New Jersey).....*neglectus* Wheeler
Last tarsal joints not at all widened.....9
9. Bristles of middle and hind tibiæ as long as the diameter of the tibia, (Florida; Maryland).....*bimaculatus* Johnson
Bristles of middle and hind tibiæ short, not as long as the diameter of tibia, (Mexico).....*mexicanus* new species
10. Face opaque with pollen.....11
Face with the metallic ground color showing through the thin pollen.....12
11. Pollen of the face white; bristles on hind margin of fourth abdominal segment short, (Massachusetts).....*prasinus* Johnson
Pollen of the face ochre yellow; bristles on the hind margin of fourth abdominal segment unusually long, (Massachusetts, Maryland, New York, Mississippi, Nova Scotia).....*ochrifacies* VanDuzee
12. Fore coxæ black with the tips narrowly yellow, (both species going here are large).....13
Fore coxæ blackish or greenish at base, broadly yellow at tip, the yellow not sharply defined.....14
13. Hind femora with a row of three or four long slender bristles on apical third of anterior surface, (Florida).....*thalassinus* new species
Posterior femora with a single preapical bristle, (California), *insulanus* new species
14. Large species with two rows of long hairs or slender bristles on upper and lower edges of anterior surface of hind femora, (Florida, Texas), *armiger* new species
Small species with only short hair on posterior femora.....15
15. Hair on posterior femora black, (Massachusetts).....*viridifacies* VanDuzee
Hair on posterior femora white, (Kansas).....*canities* new species

Thinophilus latimanus new species.

Male: Length 2 mm. Face, head, thorax and abdomen thickly covered with white pollen, on the dorsum of the thorax and abdomen there are slight purple and green reflections showing through the pollen. Palpi yellow, a little shorter than the face. Antennæ small, yellow, rounded at tip. Arista blackish. There are a few white hairs on the lower part of the head.

Thorax without acrostichal bristles; dorsocentrals small. Abdomen with a few small, white hairs. Hypopygium small, mostly concealed, with narrow, white lamellæ extending forward close under the venter.

Fore coxæ yellow, infuscated at base, their anterior surface with white pollen and rather long, abundant, white hairs; middle and hind coxæ wholly black with abundant white pollen. Femora blackish with small white hairs, base and broad tips of anterior pair, broad tips of middle ones and narrow tips of posterior pair yellow; anterior pair with three very small black bristles on lower posterior surface near the tip. Fore tibiæ yellow, with four small black bristles on upper posterior edge and one on upper anterior edge. Middle tibiæ yellow on most of basal

half, blackish on apical half, and with two small bristles above. Posterior pair mostly blackish, with three very small bristles above. Hairs on all tibiæ white and very short. Fore tarsi black; first joint compressed, 15 fiftieths of a millimeter long and 7 wide, second joint a little widened and third slightly so. Joints of fore tarsi as 15-6-6-6-6; of middle ones as 30-11-8-5-7; joints of hind ones as 18-16-11-7-7. Calypters small, yellow with very short, white cilia. Halteres yellow.

Wings milky white, veins brownish yellow; cross-vein a very little darkened with brown; third and fourth veins wide apart a little before the middle of the last section of fourth vein, approaching each other a little towards their tips; last section of fifth vein 25, cross-vein 8 fiftieths of a millimeter long.

Described from one male which I took at Colorado Springs, Colorado, June 8, 1925. Type in the author's collection.

Thinophilus mexicanus new species.

Male: Length 3 mm. Face green, dulled with thick white pollen, wide. Front and occiput wholly opaque with gray pollen. Palpi large, yellow, with a few minute yellow hairs. Proboscis black. Antennæ yellow, small, third joint nearly round, narrowly black on upper edge, the basal arista white. Orbital cilia and beard white.

Thorax nearly opaque with gray pollen, which leaves an indistinct median, bronze-brown vitta on the dorsum. There are six dorsocentral bristles in each row, which are small in front, longer posteriorly; scutellum with the pollen more brown on the center and one pair of bristles. Abdomen green with thick white pollen, much depressed, its hairs small, white, these hairs are inserted in minute black dots, which give it the appearance of being black haired when viewed from above. Hypopygium small, blackish, its appendages short, yellow, extending forward under the venter.

Fore coxæ yellow, slightly darkened at base, their hairs white, I cannot see any black bristles at tip. Femora and tibiæ wholly yellow; femora with very short yellow hairs, middle and hind pairs with small black bristles near the tip; all tibiæ with black hair and small bristles. Fore and middle tarsi black from the tip of the first joint; posterior pair more brownish from tip of first joint; all tarsi with stiff black hairs, which are inserted rather far apart. Joints of fore tarsi are as 19-7-7-6-6; of middle ones as 17-7-7-5-6; those of posterior pair as 20-17-10-6-7. Pulvilli rather large, those of anterior tarsi being nearly half as long as the fifth joint. Calypters yellow with short white cilia. Halteres yellow with a brown stem.

Wings grayish with a whitish sheen; veins brown, more yellow at root of wing; last section of fourth vein bent before its middle, third vein bent backward at tip, parallel with fourth beyond the bend in fourth; there are faint brown spots on the bend of fourth vein and on the cross-vein; the anal angle seems to be entirely effaced by the narrowing of the wing at base; last section of fifth vein 24, of cross-vein 12 fiftieths of a millimeter long.

Female: Face only a little wider than that of the male, wholly opaque with white pollen. All femora more or less infuscated; fore coxæ mostly infuscated, their hairs very short, white; fore and middle tarsi a little blackish from the tip of first joint, but not deep black as in the male; joints of fore tarsi as 14-9-7-4-6; those of middle ones as 18-8-7-6-6; and of hind pair as 18-20-11-8-8. Wings with the same white sheen as in the male, of nearly equal width, the anal angle being prominent, and the posterior margin evenly but only slightly rounded. The general color about as in the male.

Described from one pair taken by Edward P. Van Duzee. The type (male) was taken at Tepoca, Mexico, April 25, 1921; the female was taken at Gonzales Bay, Lower California, April 29, 1921.

Types in the California Academy of Sciences.

Although not taken at the same time or place, and differing somewhat in the color of the legs, I have no doubt of their being the same species.

Thinophilus depressus new species.

Male: Length 2 mm. Face and front with brown pollen. Proboscis blackish. Orbital cilia composed of a few short white hairs.

Thorax brown, with thick, coarse, yellowish brown pollen. Abdomen depressed, green, with a little yellowish brown pollen, its hairs black. Hypopygium small, mostly concealed, its appendages short, linear, yellow, extending forward close under the venter.

Fore coxæ wholly yellow, with only a few minute yellow hairs on the anterior surface and an oblique row of small black bristles at tip. Middle and hind coxæ blackish. Femora, tibiæ and tarsi yellow, the latter only slightly darker at tip; hairs of femora mostly yellow, those of tibiæ and tarsi black. Middle and hind femora each with a small preapical bristle. Joints of fore tarsi as 14-7-5-4-6; first three joints of middle tarsi are as 21-11-8; and first three joints of posterior tarsi as 12-15-9. Calypters dark yellow with short yellowish cilia.

Wings grayish, without spots on the veins; third and fourth veins straight and parallel byeond the cross-vein; anal angle of wing quite prominent; sixth vein distinct; last section of fifth vein 23, of cross-vein 8 fiftieths of a millimeter long; posterior margin of wing evenly rounded.

Described from one male taken at Loreto, Lower California, May 19, 1921, by E. P. Van Duzee. Type in the California Academy of Sciences.

The head in the type has been partly destroyed, but the species will be easily recognized by the coarse, yellowish brown pollen of the thorax, which is not found on any other species of the genus I have seen.

Thinophilus delicatus new species.

Male: Length 2.3 mm. Face and front green with thin white pollen, the former rather narrow below. Palpi large, half as long as the face, oval, covered with silvery white pollen and a few white hairs. Proboscis blackish. Antennæ yellow, a little darker above, third joint very small; arista brown. Lateral and inferior orbital cilia white, quite long, a few of the upper ones black.

Thorax and abdomen dull green; dorsum of thorax with thin brownish pollen; hairs of the abdomen mostly yellow; six dorsocentrals in each row; pleuræ with white pollen. Hypopygium brownish; conspicuous; it has a pair of long, brownish, bent appendages, which are enlarged on apical half, but pointed at tip, extending under the venter, they are fringed with hair on upper edge (lower edge if extended backward); inner surface of these appendages with long wavy hairs, these hairs nearly half as long as the appendages; between these is an elongated black appendage, rounded at tip, covered with black hair, and back of them a yellowish central organ with a black tip.

Fore coxæ wholly yellow with long white hair; middle and hind coxæ dull green on outer surface, all their hairs and bristles pale, those at tip of middle ones long. Femora, tibiæ, and tarsi pale yellow; apical joint of anterior and posterior tarsi; and the last two joints of middle ones black; hairs of the legs pale; the small bristles on middle and hind tibiæ, several hairs or very small bristles near the tips of all femora, and most of the hairs on the tarsi, black. Middle femora on basal third of lower surface and hind femora on basal half or two-thirds with delicate, yellowish white hairs, which are scarcely as long as the width of the femora. Pulvilli large, yellowish. Joints of fore tarsi as 20-19-1-70-7; of middle ones as 30-13-10-7-8; joints of posterior pair as 17-17-11-8-8. Calypters and halteres yellow, the former with short white cilia.

Wings tinged with yellow; veins and costa yellow; third and fourth veins parallel beyond the Cross-vein; last section of fifth vein 24, of cross-vein 14 fiftieths of a millimeter long; sixth vein distinct.

Described from one male taken at Atherton, Missouri, May 21, 1901. Type in the U. S. National Museum.

Thinophilus longiventris new species.

Male: Length 4 mm. Face and front covered with brownish gray pollen, the former wide, the portion below the suture shorter than wide, somewhat triangular, with a point in the center of lower edge. Palpi large, yellow, with black hairs, their pollen nearly white. Antennæ brown, lower half of first and second joints yellow; third joint rounded at tip, scarcely as long as wide, arista basal, black. Upper orbital cilia black and strong, lateral and lower cilia slender, white.

Dorsum of thorax green, with a distinct stripe of purplish brown each side of a narrow, median, shining, blue-green line, outside of these on each side is a broader, poorly defined stripe of the same brown color;

scutellum with one pair of marginal bristles, no acrostichal bristles; six quite large dorsocentrals in each row, and an area of short, stiff, black hairs inside of the humeri; pleuræ dulled with white pollen. Abdomen coppery, more green towards the tip, with numerous, short, stiff, black hairs; the white pollen on the sides abundant. Hypopygium small, mostly concealed, it has a pair of slender lamellæ fringed with long yellow hairs, these lamellæ are 26 fiftieths of a millimeter long and extend downward.

Coxæ black with their tips narrowly yellow, anterior pair with white pollen and short white hair on the front surface. Femora yellow with conspicuous black hair; posterior blackish on upper surface for nearly their whole length, lower edge also infuscated along the middle, they are cilliated on the middle of lower edge for more than half their length with slender, black hairs, which are a little longer than their width; fore and middle femora each with a glabrous stripe on lower surface, middle femora with a row of hairs on the lower posterior edge, which are longer and bristle-like towards the tip, and one preapical bristle some distance from the tip. Anterior femora with a row of slender bristles on lower posterior edge of apical half. All tibiæ yellow, posterior pair with a blackish ring at base, they have three bristles on upper anterior edge, one of which is near the tip and one smaller one on upper posterior edge near the base, they also have a close-set row of delicate black hairs on lower posterior edge, these are not as long as the diameter of the tibia. Middle tibiæ with a quite wide, glabrous stripe on both upper and lower surface and two pair of bristles above. Anterior tibiæ with two nearly glabrous stripes, which are more on the sides, they are very narrowly black at tip and have two large bristles above and two smaller ones on lower posterior edge. Fore tarsi yellow, with the upper surface and tips of the joints blackish, last joint wholly black, distinctly flattened, the first four joints with delicate hairs below, one or two of which on each joint are longer than the rest, and each with a small bristle at tip. First four joints of middle and hind tarsi with a stout bristle at tip below, their fifth joints a little flattened, these tarsi have the first two joints yellow with black tips, the remaining joints mostly blackish. Joints of fore tarsi as 21-9-9-9-12; those of middle ones as 42-10-9-7-9; joints of posterior pair as 34-24-18-15-16. Calypters small, yellow, their cilia short, white. Halteres yellow.

Wings grayish, veins blackish, base of first and second veins yellow third and fourth veins approach each other towards their tips last section of fifth vein 36, cross-vein 20 fiftieths of a millimeter long.

Described from two males, taken by Edward P. Van Duzee. The type at Gonzales Bay, Lower California, April 28, 1921; the paratype at Tepoca Bay, Sonora, Mexico, April 25, 1921.

Type in the California Academy of Sciences.

Thinophilur thalassinus new species.

Male: Length 4–4.3 mm. Face and front green with white pollen, which sometimes nearly conceals the ground color, face wide. Palpi yellow, obliquely truncate at tip, nore or less tinged with brown, their hairs black. Proboscis brown. Antennæ yellow, brown at tip- third joint small; arista brown. Lateral and inferior orbital cilia white, moderately long, a few of the upper cilia short and black.

Thorax and abdomen green, dulled with white pollen, which leaves a median shining line on the dorsum of the thorax, this line is violet in one specimen and extends across the scutellum; there are no acrostichal; six dorsocentrals and one pair of scutellar bristles; hairs of the abdomen black. Hypopygium mostly concealed, it has a pair of long yellow appendages projecting downward and fringed with white hairs, also a pair of glabrous, black points extending forward under the venter, these reach the hind margin of the third ventral segment.

All coxæ black, covered with white pollen; anterior pair narrowly yellow at tip, their hairs white, no black bristles at tip. Fore femora more or less infuscated, sometimes only slightly so. Middle and hind femora yellow, each with a small preapical bristle on anterior surface; middle pair with four small bristles on posterior surface near the tip; posterior pair with long black hair below on apical two thirds, which is longest near the middle, but scarcely as long as the width of the femora. Tibiæ yellow; posterior pair with a glabrous stripe above, in one specimen they have a faint basal ring of darker color; each tibia with two large bristles on upper anterior edge. Tarsi yellow, last two or three joints brown or black; fifth joint of fore and middle pairs slightly widened, first joint of middle ones with small bristles below near apical third. Joints of fore tarsi as 26-9-6-8-11; those of middle ones as 43-11-9-7-10; joints of hind pair as 36-23-17-12-15. Calypters and halteres yellow, the former with white cilia.

Wings grayish; veins brown; last section of fourth vein straight, third vein bent so as to be furtherest from fourth a little beyond the cross-vein; last section of fifth vein 33, cross-vein 18 fiftieths of a millimeter long.

Female: Face and front coppery with white pollen; palpi as in the male. Dorsum of the thorax with a median green line, a narrow coppery line each side of this and a wider, less distinct coppery stripe on lateral sides; scutellum coppery; coxæ as in the male; femora and tibiæ yellow; posterior femora with a row of slender black bristles on apical half of anterior surface; anterior tibiæ with two bristles below and three pair above; middle tibiæ with three bristles below and three pair above; posterior tibiæ with two rows of bristles above, one of four and the other of six bristles, and about seven smaller ones below; posterior femora with a row of small bristles on upper anterior surface, ending in a rather small preapical bristle; fore and middle tarsi blackened from the tip of the first joint; posterior ones almost wholly black; the first three joints of all tarsi have a small bristle at tip below; anterior and posterior tarsi have short, dense hairs on the lower surface of first joint. Joints of fore

tarsi as 30-13-12-9-10; those of middle ones as 43-15-12-10-10; and of posterior pair as 27-28-20-11-15. Wings as in the male, except that the cross-vein is 21 fiftieths of a millimeter long.

Described from two males and one female, taken at Biscayne Bay, Florida, by Mrs. Slosson. Type and allotype in the U. S. National Museum.

Thinophilus armiger new species.

Male: Length, 4-5 mm. Face wide; face and front green with thin white pollen. Palpi yellow, thickly covered with white pollen, their apical edge rather straight. Proboscis black. Antennæ yellow, third joint small; arista brown. Lateral and inferior orbital cilia white, a few of the upper cilia black.

Thorax and abdomen green, the former with coppery vittæ on the dorsum, the latter with coppery reflections; no acrostichal bristles; five dorsocentrals in each row; hairs of the abdomen black. Hypopygium mostly concealed; it has a pair of long, slender, hairy, yellow or yellowish brown appendages projecting downward, and a pair of little black points extending forward.

Fore coxæ yellow, a very little infuscated at base, hairs on anterior surface small, white, there are a few black hairs at tip, these are scarcely large enough to call bristles; middle and hind coxæ infuscated on basal half, yellow apically. All femora and tibiæ wholly yellow, fore femora with two rows of little black spines below, those in anterior row the stoutest, anterior tibiæ with a row of little black spines below, extending their whole length, these are very short at base, but nearly as long as the width of the tibia near the tip, these tibiæ are glabrous on anterior surface and have four bristles above. Middle femora with long bristly hairs on anterior surface, their tibiæ with a row of six long slender bristles on lower surface, two bristles on posterior surface and three bristles on upper surface of basal half. Hind femora with quite long, bristly hairs on anterior surface. Hind tibiæ with four pair of bristles on upper surface and several irregular ones below. First four joints of all tarsi with a small spur at tip below; fore tarsi yellow, darker at tip, their first joint with close-set, little hairs below; middle tarsi blackish towards the tip; hind tarsi black from the middle of the first joint; joints of fore tarsi as 19-9-8-5-9; of middle ones as 35-14-10-9-11; those of posterior pair as 26-23-20-11-14. Calypters and halteres yellow, the former with short white cilia.

Wings grayish, veins brown, first and second veins mostly yellow; third and fourth veins approach each other a little towards their tips; last section of fifth vein 31, cross-vein 17 fiftieths of a millimeter long.

Female: Color of all parts about as in the male; fore coxæ with the white hair more conspicuous, the black hairs at tip very minute and forming an apical comb. Fore and middle femora without long hair or bristles; hind femora with long bristly hair on anterior surface; fore and middle tibiæ with three pair of bristles above and three bristles

below; hind tibiæ with two rows of bristles above, one of four and the other of six bristles. First three joints of all tarsi with a small bristle at tip below.

Described from three males and three females. All but one male paratype were taken at Biscayne Bay, Florida, by Mrs. Slosson; one male was taken at Galveston, Texas, June 10, 1917, by J. M. Aldrich.

Type and allotype in the U. S. National Museum, and were taken in Florida.

Thinophilus nigripilosus new species.

Male: Length, 2 mm. Face covered with grayish brown pollen, which nearly conceals the ground color. Palpi as long as the width of the face, covered with white pollen. Proboscis brown. Front brownish, its pollen white. Antennæ yellow, third joint small; arista brown. Lateral and inferior orbital cilia white, short.

Thorax and abdomen greenish with coppery reflections; dorsum of thorax dulled with grayish white pollen; hairs of the abdomen black. Hypopygium mostly concealed; it has a pair of long, slender, yellow appendages, extending downward and forward and fringed with hairs.

Fore coxæ yellow, a little darkened at extreme base, their anterior surface with a few white hairs, and at tip a row of small black hairs. All femora, tibiæ and tarsi yellow, their hairs black, tips of tarsi darkened. All femora with a row of black hairs below, which are small at base, becoming longer apically, where two or three are about as long as the width of the femora at point of insertion. Three first joints of middle and hind tarsi with a small bristle at tip below. Joints of fore tarsi are as 10-5-5-4-5; those of middle ones as 17-8-6-4-5; joints of posterior pair as 12-10-7-7-7. Calypters and halteres yellow, the former with very short, white cilia.

Wings grayish, veins brown, a little yellow at root of wing; third and fourth veins nearly parallel beyond the cross-vein; last section of fifth vein 29, cross-vein 8 fiftieths of a millimeter long; sixth vein distinct, ending abruptly before reaching the wing margin.

Described from one male, taken at Galveston, Texas, June 10, 1917, by J. M. Aldrich. Type in the U. S. National Museum.

Thinophilus canities new species.

Male: Length, 2.2 mm. Face wide, its sides nearly parallel, green with gray pollen. Front bronze green. Palpi nearly rectangular, a little shorter than the antennæ, which are wholly yellow with a black arista. Orbital cilia and beard white.

Thorax and abdomen green with coppery reflections; covered with white pollen, which is abundant, but scarcely dulls the ground color; hairs of the abdomen white, but sometimes appearing black when viewed

from above, because of the minute blackish dots at base of the hairs. Hypopygium mostly concealed, outer appendages rather long, yellow; inner ones still longer, extending forward under the venter.

Fore coxæ yellow with silvery white pollen and minute white hair; middle and hind coxæ blackish with yellow tips and thick white pollen. Femora, tibiæ and tarsi yellow; last joint of all tarsi brown; hairs of the legs white and short, their bristles small, black. Joints of fore tarsi as 17-8-6-5-5; of middle ones as 26-9-7-6-7; joints of posterior pair as 18-14-9-6-8. Calypters, their very short cilia and the halteres pale yellow.

Wings milky white, veins wholly yellow; third and fourth veins almost parallel beyond the cross-vein; last section of fifth vein about 30, cross-vein 10 fiftieths of a millimeter long.

Female: Length, 2.3–3 mm. Face and front green with thick white pollen. Palpi nearly as long as the face, more than half as wide as long, yellow, with thick silvery white pollen and white hair. Proboscis dark brown. Antennæ wholly yellow; arista blackish. Lateral and inferior orbital cilia and beard white, a few of the upper cilia black and very small; there are also several small black bristles extending from the postverticals downward to meet the orbitals where the black cilia end.

Thorax and abdomen green, covered with white pollen; abdomen with white hair. Fore coxæ yellow, sometimes slightly infuscated at extreme base, their hair and pollen white. Femora, tibiæ and tarsi yellow, tarsi scarcely darkened at tip, hind femora with a small black bristle near apical third of anterior surface. First four joints of tarsi with a minute bristle at tip below, anterior pair with minute black spines on lower surface. Joints of fore tarsi as 20-10-8-6-9; of middle ones as 32-11-9-5-8; and of posterior pair as 23-16-10-7-9. Calypters and halteres yellow, the former with short white cilia. Wings grayish, veins yellow, a little darker towards the tip of wing; third and fourth veins nearly parallel beyond the cross-vein; last section of fifth vein 32, cross-vein 17 fiftieths of a millimeter long.

Described from two males and two females, taken by J. M. Aldrich, in Douglas Co., Kansas, in June, at an elevation of 900 feet.

Type (male) and allotype (female) in the U. S. National Museum.

Thinophilus magnipalpus new species.

Male: Length, 2.2 mm. Face green with grayish white pollen, wide below, but the eyes nearly touching near the antennæ. Front bronze green with gray pollen. Palpi somewhat quadrilateral in outline, as long as the face, more than half as wide as long and with minute white hairs, covered with silvery white pollen. Proboscis black. Antennæ wholly yellow; third joint small; arista brown, whitish towards its tip. Orbital cilia white; I cannot see any black cilia above.

Thorax and abdomen green with coppery reflections, dulled with whitish pollen; dorsum of thorax with five dorsocentrals in each row,

the first four small; hairs of the abdomen white. Hypopygium mostly concealed; it has a pair of yellowish points extending forward under the venter.

Fore coxæ wholly yellow, covered with white pollen, they appear nearly bare, but have a few minute white hairs; middle and hind coxæ infuscated at base, yellow at tip. Femora, tibiæ and tarsi yellow with white hair; last two joints of all tarsi infuscated; tibiæ with small black bristles. Joints of fore tarsi as 16-8-5-4-5; those of middle ones as 28-9-6-4-6; joints of posterior pair as 18-13-9-6-8. Calypters and halteres yellow, the former with short white cilia.

Wings whitish; veins yellow, more brown at tip of wing; third and fourth veins nearly parallel beyond the cross-vein; last section of fifth vein 29, cross-vein 12 fiftieths of a millimeter long.

Female: Face nearly opaque with yellowish gray pollen. Palpi small, one-third as long as face, with conspicuous black hairs. Coxæ as in the male; hairs of femora pale, those of tibiæ and tarsi black. Abdomen with black hairs; fourth segment with bristle-like hairs. Wings grayish with brown veins; last section of fifth vein 30, cross-vein 10 fiftieths of a millimeter long. Otherwise about as in the male, except that the joints of fore tarsi are as 18-8-7-5-6; those of middle ones as 25-10-9-5-6; and of hind tarsi as 15-15-10-7-7.

Described from one male and five females, taken at Las Cruces, New Mexico, June 15, 1917, by J. M. Aldrich.

Type female, allotype male in the U. S. National Museum.

It seems best to make the female the type of this species and the male the allotype, as the male may possibly prove to be the same as that described as *canites*, while the females of the two species differ widely. This is the second species in which the female has very long hairs or bristles on the hind margin of fourth segment, the other is *ochrifacies* Van Duzee, in that species these long hairs are only found on the hind margin of fourth segment, while in this form they are found on the hind margins of both third and fourth segments.

Thinophilus spinipes new species.

Male: Length, 7 mm. Face wide, opaque with grayish pollen, except a metallic golden spot just above the transverse ridge, the portion of the face below this ridge is scarcely half as long as wide and with a small point on the middle of the lower edge. Palpi large, oval, yellow, with a few conspicuous black hairs, each three-fourths as long as the face. Proboscis blackish. Front with a coppery bronze stripe on each side near the orbit, ocellar tubercle blue-green, otherwise the front is nearly opaque with gray pollen. Antennæ small with a brown spot above, the apical margin brown; third joint rounded at tip; arista black. Lower orbital cilia and beard long, white; the upper orbital cilia black and in two irregular rows.

Dorsum of thorax green, but nearly covered with brownish pollen, which forms a narrow line on each side of a median green stripe; no acrostichal bristles, other bristles of the thorax well developed. Abdomen dark shining green with stiff black hair. Hypopygium black, with long, black, narrow lamellæ, which reach the ventral edge of the fourth segment, and are fringed with black hair.

Coxæ and femora black, tips of all femora and fore and middle trochanters yellow; anterior trochanters with a black bristle and several small hairs below; anterior surface of fore coxæ covered with long, black bristles; all the hair and bristles of the legs and feet black. Fore femora with two rows of bristles below; middle ones glabrous on posterior surface and with a row of rather long hairs on lower anterior edge. Posterior femora with a row of quite long bristles on both upper and lower edges of anterior surface. All tibiæ yellowish brown; fore and middle ones with large bristles above; posterior pair with many long bristles both above and below; anterior pair with a cluster of three long bristles below near the tip. Fore tarsi yellow with the fifth and narrow tips of the other joints black; first joint a little bent, concave below, base prominent below and with a comb of minute spines which are continued along the lower edge of the joint; posterior surface of all joints fringed with long hairs; fifth joint a little flattened, nearly round in outline. Middle tarsi yellow with each joint successively increasingly black at tip, the fifth being more than half black; three apical joints flattened and gradually widened, the base of the fourth and fifth appear white, because of the silvery pollen on the yellow portion, the three last joints fringed with long hairs on the edges. Posterior tarsi brown, becoming black towards the tip. Joints of fore tarsi as 39-21-15-10-11; of middle ones as 62-20-14-9-17; joints of posterior pair as 45-28-23-18-14. Fore pulvilli quite large, white; middle and hind ones smaller and brown. Calypters and halteres yellow, the former with white cilia.

Wings grayish with an inconspicuous blackish spot on the cross-vein and another on the middle of the last section of the fourth vein, this section of fourth vein is a little arched, but is parallel with third apically for more than half its length; last section of fifth vein 47, of cross-vein 21 fiftieths of a millimeter long.

Female: Length, 4–4.5 mm. Face as in the male; beard grayish white, very slightly tinged with yellow; pollen of the thorax gray; fore trochanters without a bristle. Fore and middle femora with abundant bristly hair on the lower surface, the middle ones with the posterior surface glabrous; hind femora with the bristles smaller than in the male. Tarsi plain, fore and middle pairs black from the tip of the first joint; posterior tibiæ and tarsi black. Fore tibiæ with two, middle ones with three large bristles below, the former without the cluster of bristles found in the male; bristles of hind tibiæ less numerous and smaller than in the male. Joints of fore tarsi as 35-14-10-7-9; of middle ones as 55-20-15-10-10; those of posterior pair as 40-28-20-13-16. Cross-vein of the wing 25, last section of fifth vein 48 fiftieths of a millimeter long.

Described from many males and females. The type, male, was taken at Baldur, Manitoba, June 23, 1924, by N. Criddle; and is in the Canadian National collection at Ottawa. The allotype and one paratype I took at Wells, Nevada, June 6, 1915, the other paratype was taken at Great Salt Lake, Utah, July 5, and is in the United States National Museum. The other paratypes were taken Baldur, Manitoba.

Thinophilus rufibarbis new species.

Female: Length, 5.5 mm. Face wide, nearly opaque with grayish brown pollen, the coppery ground color showing through a little, the portion below the suture one-fourth as long as wide. Palpi large; yellowish white, with stiff black hairs, rounded at tip. Front coppery, green in the center, dulled with brown pollen. Antennæ yellow; arista brown. Beard composed of numerous, blunt, orange yellow bristles; upper orbits with two rows of little black bristles which unite below and reach down to the middle of the eye.

Dorsum of thorax nearly opaque with grayish brown pollen; pleuræ with the pollen more gray; propleuræ with three long, orange yellow bristles above the fore coxæ and above these a cluster of stiff hairs of the same color; scutellum with two pair of marginal bristles, the outer pair half as long as the middle ones. Abdomen green with coppery reflections and stiff black hair.

All coxæ black with yellow tips and gray pollen; fore and middle coxæ with stiff black hair, those on anterior pair long and bristle-like. Femora black, their tips, extreme base and the trochanters yellow; hair on all femora long, black and bristly. Fore and middle tibiæ yellow, posterior tibiæ mostly blackish; anterior tibiæ with nine bristles above, four in one row and five in the other, also four small bristles below; middle tibiæ with two rows of four bristles above and three bristles below; posterior tibiæ with two rows of five bristles each above and several bristles below. Fore tarsi black from the tip of the first joint; middle ones yellow with the tips of first four joints and whole of fifth black; posterior tarsi mostly black, tips of the joints of all tarsi with a minute bristle below. Joints of fore tarsi as 42-18-14-10-14; of middle ones as 58-21-16-12-15; joints of posterior ones as 43-31-21-15-15. Calypters and halteres yellow, cilia of the former short and white.

Wings tinged with brown, more grayish on posterior half; a conspicuous brown spot on the cross-vein and another on the slight bend in the last section of the fourth vein; cross vein 26 fiftieths of a millimeter long.

Described from one female taken at Saltair, Great Salt Lake, Utah, July 5, by Dr. J. M. Aldrich.

Type in the U. S. National Museum.

This female is very nearly like those described as *spinipes* new species, but I am quite sure they are distinct species; these

have the portion of the face below the suture half as long as in *spinipes*, the beard is composed of coarser hairs, which are reddish yellow and rather dark in color. The joints of the tarsi also differ somewhat in length in the two forms.

Thinophilus insulanus new species.

Female: Length, 4 mm. Face and front green, dulled with brown pollen. Palpi yellow, darker at base, with many black hairs. Proboscis brown. Antennæ and arista brown, first and second antennal joints more yellowish on lower half. Upper orbital cilia black, lateral cilia and the beard whitish.

Thorax and abdomen green; dorsum of thorax nearly opaque with brown pollen, which leaves a median shining green stripe; six quite large dorsocentrals in each row; just above each fore coxa is a cluster of stiff pale hairs, above these a large brown bristle, and still higher more pale hairs. Abdomen covered with whitish pollen and short, stiff, black hair.

All coxæ black with extreme tips yellow; hairs on fore and middle pairs white, no black bristles at tip of anterior pair. Femora, tibiæ and tarsi yellow with stiff black hair, sometimes the extreme tips of anterior and posterior tibiæ are brown, tarsi more or less brown towards their tips; each tibiæ with one bristle near the middle of lower surface; each joint of the tarsi with a more or less distinct bristle at tip below. Joints of fore tarsi as 25-11-8-9-13; those of middle pair as 42-14-13-11-13; joints of posterior tarsi as 32-25-20-17-12. Calypters and halteres yellow, cilia of the former short and white.

Wings grayish, without spots on the veins; veins brown; fourth vein nearly straight beyond the cross-vein, third gently arched so as to be furtherest from fourth at the middle of the last section of fourth vein; cross-vein 29, last section of fifth vein 38 fiftieths of a millimeter long; sixth vein reaching half way to the wing margin.

Described from seven females, which I took at North Island, San Diego, California, April 5, 1915.

Type in the author's collection; paratypes in the U. S. National Museum, the California Academy of sciences, and the American Entomological Society.

PARTIAL SYNOPSIS OF AMERICAN SPECIES OF VOLUCELLA WITH NOTES ON WIEDEMANN'S TYPES.*

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During the examination of such species of Syrphidæ described by Wiedemann as are contained in the Vienna Natural History Museum, made possible by the courtesy of Dr. Hans Zerny a few obvious misdeterminations of species of *Volucella* have become evident. As the relationships of the various species can best be shown by means of a key, I have prepared one based almost entirely on species before me. The species included by Williston in the Biologia Centrali-Americana have been included in the key, although several have not been seen and in one or two cases the position of the species may be somewhat doubtful owing to different interpretation of the characters.

The genus *Volucella* is a large one and is distributed in all parts of the world. Attempts to split the genus have proved unsuccessful and the group is best treated as comprising a single genus with the exception of a very few well characterized forms which may be treated as genera. The genera *Phalacromyia* and *Temnocera* are so feebly characterized and intergrade so well into *Volucella* as to be of little or no value although the former, if restricted to those species with preapical scutellar depression, is quite satisfactory and if further restricted to species with both the apical and lateral depressions becomes sharply limited and may then be considered a valid genus. The genera *Apophysophora*, *Viereckomyia*, *Copestylum*, *Lepidopsis* and *Graptomyza* are readily distinguished from *Volucella*. The last named does not occur in America, while the four others are peculiar to this continent.

In reviewing the species described by Wiedemann, those which have not been sufficiently characterized nor subsequently redescribed are treated in detail in the present paper.

*Contribution from the Division of Systematic Entomology, Entomological Branch, Department of Agriculture, Ottawa, Canada.

In two cases the original descriptions are found to be misleading, but on the whole Wiedemann's work is remarkably clear and recognition almost certain when the descriptions are adhered to strictly. Wiedemann was familiar with most of the Fabrician species, having had access to the collection and often having duplicate specimens of series described by Fabricius. For this reason Wiedemann's descriptions of Fabricius' species are most valuable and are often based on type material. The redescription of some species by Wiedemann must be overlooked as it was obviously impossible for him to compare all specimens and the condition of Fabricius' species may often have been such as to be misleading.

Great difficulty has been experienced in determining species described by Macquart and Bigot, even though the latter presents keys to all the species previously described. While most species are quite constant in color, others are variable and for this reason Bigot's keys, based on descriptions, are difficult to follow.

In the key I have indicated the regions where the species occur as follows: (T) tropical, usually widespread; (N) Nearctic, occurring North of Mexico. A few of the species have a very large range but on the whole they are restricted to either of the two regions or intermediate zones.

KEY TO MAIN DIVISIONS.

A. Scutellum with preapical depression (Sub-genus Phalacromyia).....2
Scutellum without preapical depression.....B
B. Eyes with scales among the pile, or the scutellum with from one to three strong tubercular swellings.....69
Eyes with normal pile; scutellum not with dorsal tubercles.....C
C. With prescutellar row of bristles.....20
Without prescutellar row.....42

SYNOPSIS OF SPECIES.

1. Scutellum with pre-apical depression.....2
Scutellum differently shaped, flattened to strongly convex, sometimes with tubercles or angular production basally.....18
2. Deep metallic green species.....3
Not metallic green.....4
3. Eyes with dense, short, thickened white pile; cheeks with yellow triangle; tarsi reddish (T).....*viridis* Will.
Eyes with normal cinereous pile; cheeks wholly green, tarsi black or brown (T).....*ernesta* n. sp.
4. Bristles of thorax yellow.....5
Bristles of thorax black.....10
5. Wings with sharply defined, triangular apical brown cloud, (T), *tympanitis* Fabr.
Wings not with conspicuous apical spot.....6

6. Squamæ brown, or at least with brown border.....7
Squamæ yellowish (T).....*pallens* Wd.
7. Pleura wholly pale.....8
Pleura with two blackish spots below.....9
8. Dark abdominal bands linear.....9a
Abdominal black bands broad, sometimes the apical half of abdomen all black; scutellum black pilose (T).....♀ *musta* Will.
9. Scutellum yellow pilose; dark abdominal bands linear (T).....*vaga* Wd.
Scutellum black pilose; abdominal bands broad, usually connected in middle or leaving only small yellow spots.....*musta* Will.
9a. Face short, the oral angles short; scutellum wholly yellow haired, (British Guiana).....*brevifacies* Curran
Face longer, acute below; scutellum largely black pilose (T)..♀ *vaga* Wd.?
10. Scutellum without lateral flattened or depressed, roughened areas.....11
Scutellum with lateral, roughened depressed or flattened areas.....16
11. Squamæ and fringe brownish or black, at least the border and fringe brown..12
Squamæ and fringe yellowish, the fringe may be reddish; very pale species; cheeks with obscure brownish line in front; face produced downwards as long, slender cone; front black (T).....*punctifera* Big.?
12. Face with median brown or black stripe.....13
Face without median dark vitta; legs brown, hind basitarsus reddish; cheeks with slender line; face produced strongly downwards as slender cone; thorax rusty brown, the disc violaceous; scutellum wholly black pilose, abdomen shining black with the broad base pale (T).....*johnsoni* Curran
13. Legs wholly black; blackish species with longish pile.....*vierecki* Curran
Coxæ yellow or legs otherwise pale.....14
14. Thorax wholly pale, the dorsum black haired; scutellum with large roundish black spot covering most of its surface, (West Indies).....*discalis* n. sp.
Thorax largely dark or practically all pale haired; scutellum differently colored.....15
15. Scutellum with yellow base and apex; facial stripe broad and reaching the antennæ; front of ♀ usually pale except above, (Brazil).....*mus* Willist.
Scutellum wholly violaceous; facial stripe narrow, not nearly reaching the antennæ; front of ♀ black.....*fracta* n. sp.
16. Lateral depressions on scutellum about as long as wide, (Central America), *tricincta* Bigot
Lateral depressions decidedly transverse.....17
17. Fourth abdominal segment entirely pale; ferruginous species with narrow black apices to second and third abdominal segments, (Brazil), *chalybescens* Wd.
Fourth segment black, or at least bordered with black, (T)..*deceptor* Curran
18. Eyes with scales among the abundant hairs; or the scutellum strongly produced upwards in middle at base or with two or three strong non-setigerous tubercles.....69
Eyes without squamose hairs; scutellum normal sometimes with small setigerous marginal tubercles.....19
19. With a prescutellar row of bristles or at least one pair or some short stout ones in the middle before the scutellum.....20
Without prescutellar row, although the pile may be long.....42
20. Second longitudinal vein not regular, but curved back so that the marginal cell is much broadened before its tip; marginal cell always closed.....21
Second longitudinal vein regular, the marginal cell scarcely widened.....23
21. Metallic green species; one pair of small prescutellars; a small dot at apex of marginal cell (*obesoides* G. T.?) (T).....*aemula* Willist.
Not metallic green; no spot at apex of marginal cell.....22
22. Four very strong setose tubercles on thorax; legs blackish, (Paraguay, Argentine).....*spinithorax* Arib.
Six strong setigerous tubercles and a weak basal pair, (Argentine, Uruguay), *spinigera* Wd.

23. Epistoma strongly projecting forwards and acutely conical; third antennal joint rather kidney-shaped; face scarcely produced downwards, (Mexico), *haagi* Jaen.
Face, if produced somewhat forward below, also produced conspicuously downwards and other characters not agreeing....24
24. Face with dark median vitta, or wholly dark....25
Face without brown or black median vitta; wholly pale, except on sides or cheeks....27
25. Face and front steel blue; wholly chalybeus or metallic greenish blue; wings with quadrate black spot in middle anteriorly, (Chile)....*azurea* Phil.
Face pale with median black vitta....26
26. Thorax with geminate yellow spot behind; tibiæ reddish basally; abdomen with the second segment pale yellow, (Mexico)....*comastes* Will.
Thorax wholly greenish cyaneous; legs wholly black; second abdominal segment yellow with median vitta and narrow apex black, the two following with more or less distinct basal reddish band which is widened laterally, often not at all reddish....*macquarti* n. sp.
27. Wings without distinct brown spots, sometimes dilutely infuscate....28
Wings with one or more sharply defined brown spots....36
28. Abdomen wholly metallic green; no anterior stripe on cheeks; legs reddish, the femora chiefly black above; squamæ thick, the fringe short, rusty reddish; wings hyaline, the stigmal spot brown, (U. S.)....*barei* Curran
Not such flies....29
29. Abdomen deep violet, the base light yellow, wings infuscate, head broad, face produced acutely downwards....*amethistina* Bigot
Abdomen differently colored or otherwise different....30
30. Scutellum armed with six or eight strong setigerous tubercles; large, blackish species with rusty brown scutellum; face reddish yellow, the oral margin narrowly black, (Chile, Argentine, Peru)....31
Scutellum without setigerous tubercles, although the spines may have a slightly raised base....32
31. Face rusty reddish; cheeks not black behind; tibiæ reddish, (Peru), *bradleyi* Curran
Face more yellowish, antennæ brownish; cheeks broadly black behind; tibiæ blackish, rarely reddish brown....*scutellata* Macq.
32. Head very large, inflated, no facial tubercle, the face carried straight down into a slender acute cone; squamæ white with brown border and fringe; thorax soft white pilose with black hairs intermixed; abdomen fasciate with yellow and brown or black, (Chile)....*concinna* Phil.
Head not unusually large, facial tubercle present....33
33. Abdomen brownish black, shining; thorax cobalt blue; legs castaneous; frontal triangle black pilose, (Mexico)....*chaetophora* Will.
Abdomen not wholly shining black; if wholly dark the frontal triangle is pale pilose....34
34. Squamæ white, the outer half of lower lobe of squama rusty yellow and much thickened (N. T.)....*vesiculosa* Fabr.
Outer lobe not thickened and differently colored....35
35. Squamæ with yellow border and fringe; abdomen yellowish with median black spot on second and third segments, (Brazil)....*dorsalis* Wd.
Squamæ with black border and fringe; abdomen black with second and third segments largely yellow (T)....*persimilis* Will.
36. Abdomen entirely pale yellow; thorax rusty yellow, (Venezuela), *unicolor* Curran
Abdomen not entirely yellow, at least black fasciate....37
37. Scutellum with six or eight strong setigerous tubercles, (Chile), (c. f. couplet 30)....*scutellata* Macq.
Scutellum without strong tubercles....38
38. Thorax and abdomen blackish, greenish opalescent; scutellum brown with dull disc; wings with apical cloud or the veins strongly margined, (Venezuela)....*alcedo* Curran
Differently colored....39

39. Abdomen yellow with very narrow black segmental apices; scutellum reddish above, flattened before its tip, (Mexico) ..... *opinator* Willist.
Abdomen differently colored 40
40. Squamæ whitish, the outer half of the lower lobe orange, much thickened; fringe pale ..... *vesiculosa* F.
Squamæ with black fringe 41
41. Face very strongly produced downwards; plumula brown, (T), *cyanescens* Macq.?
Face moderately produced downwards, rather obtuse; plumula pale yellowish, *macula* Wd.
42. Thorax and abdomen with long, abundant pile, that on the thorax largely yellow ..... (*V. bombylans* varieties)
Thorax and abdomen with shorter, sparser pile, the ground color not concealed 43
43. Second longitudinal vein, near its extremity, distinctly curved downwards, the marginal cell therefore broadened and always closed* 44
Second vein regular, the marginal cell not noticeably broadened apically, sometimes open 58
44. Wholly deep metallic blue, green or violaceous; a small brown spot at apex of marginal cell (NT) ..... *obesa* Fabr.
Not of this color 45
45. Head very large, face inflated, almost perpendicular retreating below; pale yellowish; wings with a large quadrate brown spot in front near the middle; mesonotum black, the sides, narrowly contiguous prescutellar band and scutellum pale yellow, (Mexico) ..... *quadrata* Will.
Facial tubercle usually present; head not inflated; if the face is perpendicular, the wings lack the quadrate spot, the veins alone being clouded 46
46. Margin of scutellum with very evident bristles 47
Bristles of scutellum scarcely differentiated from the hairs 50
47. Face with median black stripe 48
Face without median black stripe 49
48. Mesonotum thickly yellow pilose, (Mexico) ..... *caesariata* Will.
Mesonotum thinly long black pilose, (Mexico, U. S.) ..... *fraudulenta* Will.
49. Thorax with a rectangular yellow spot before the scutellum, broadly separated from lateral stripes; abdomen yellow with deep black segmental apices; a broad median vitta on second segment and the first segment wholly black, *satur* O. S.
Abdomen reddish yellow, otherwise marked with brownish black, *mellea* Jaen
50. Face perpendicular, not tuberculate; marginal cell not bulbous and broadly rounded at apex; wings with clouds only on the cross-vein near the middle, 51
Face concave above; wings with brown bands apically; marginal cell bulbous apically 52
51. Mesopleura with a large oval white spot behind, (U. S.) ..... *fornax* Tns.
Mesopleura wholly dark, (U. S.) ..... *avida* O. S.
52. Mesopleura with whitish yellow spot above 53
Mesopleura wholly blackish 56
53. A yellow spot on sternopleura, hypopleura and metapleura, (N), *fasciata* Macq.
No pale spots on metapleura and sternopleura 54
54. Second abdominal segment wholly pale in front, the first also wholly pale; posterior femora yellow on basal half (T) ..... *picta* Wd.
Second segment black with crescentric yellow spot 55
55. Legs reddish, the tarsi paler basally 57
Legs black, the first two tarsal segments yellow (N) ..... *pusilla* Macq.
56. Scutellum yellow pilose, (Mexico) ..... *imitans* n. sp.
Scutellum with dense black pile on apical half ..... *timberlakei* n. sp.

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*I am not certain whether *lata*, *castanea* and *isabellina* should come here. Williston uses the broadening in the sense in which it occurs in *fasciata*, while I include the angular broadening.

57. Mesonotum thickly reddish yellow pilose, (Mexico).....*ornata* Will.
Mesonotum chiefly black pilose, (W. I.).....*unipunctata* n. sp.
58. Abdomen unicolorous or practically so.....59
Abdomen banded with reddish yellow, sometimes only the base broadly pale.....67
59. Abdomen metallic green, (small species), (U. S.).....*barei* Curran
Abdomen not metallic green.....60
60. Abdomen violaceous.....61
Abdomen not strongly violaceous.....64
61. Face pale yellow; cheeks black; front yellow pilose.....62
Face rusty reddish or brownish; wings blackish on basal half in front.....63
62. Scutellum pale yellow, wings with only the veins in the middle clouded with luteous, (Cuba).....*abdominalis* Wd.
Scutellum rusty reddish or brownish; wings with rectangular median cloud in front and luteous between the cloud and base, (Jamaica)..*eugenia* Willist.
63. Wings blackish on basal half in front; face with low, large tubercle; marginal cell closed.....*mexicana* Macq.
Wings wholly lightly infuscated; face very strongly produced forwards below and with small prominent tubercle below the concavity; marginal cell broadly open, (Peru).....*nigripes* Big.
64. Wings with the basal half blackish or dark brown on anterior half; but often with a broad hyaline indentation behind well before the middle; large, broad species, (B. C. to S. America).....*esuriens* Fabr.
Wings not so marked, either brown basally, without a median spot or with a median spot and only the base brown, or wholly hyaline.....65
65. Wings wholly hyaline, the base but little brownish; crossveins never darkened, (U. S.).....*comstocki* Will.
Crossveins darkened or the base of the wing broadly pale brownish.....66
66. Abdomen castaneous with slightly purplish reflections; crossveins clouded, (Mexico).....*postica* Say
Abdomen deep black; only the anterior crossvein clouded; subcostal cell and wing base brownish, (U. S.).....*anna* Will.
67. Wings strongly infuscated on basal portion; very large species, red or reddish yellow, (Mexico).....*macrocephala* G. T.
Wings not strongly infuscated basally; abdomen and thorax largely black..68
68. First abdominal segment black, (U. S., Mexico).....*isabellina* Will.
First abdominal segment and basal half of the second, and elongate transverse spots on third and fourth segments, yellow or reddish, (Brazil), **lugens* Wd.
69. Eyes with white scales scattered among the dense black hair, (Brazil), *Lepidopsis compactus* Curran
Eyes without scales.....70
70. Base of the scutellum produced strongly upwards in the middle as an angular tubercle; metallic green; short compact species, (Colombia), *Viereckomyia gibbera* Schin.
Scutellum with two or three prominent, basal tubercular swellings, genus *Apophysophora* Will.

Volucella ernesta n. sp.

Allied to *viridana* Townsend but lacks any black hairs on the mesonotum. Townsend does not state whether there is a depression on the scutellum and does not mention the darker brown spot at apex of marginal cell. The other green species described by Townsend have a prescutellar row of bristles.

Length, 9 mm. *Female.* Face and front metallic blue-green with more or less strong violaceous reflections, the cheek violaceous with a

* *V. lugens* Willist. from Mexico is a different species.

long yellowish triangle. Face whitish pollinose immediately below the antennæ, and a triangular spot of cinereous pollen extends from the eye towards the oral angles; face deeply-concave above, strongly produced downwards, the tubercle strong. Front strongly concave below the middle, the lateral depressions broad but not long, the pile white on lower half, black above. Occiput grey pollinose, whitish pilose. Eyes with short, not abundant whitish pile. Antennæ brownish red; third joint moderately broad, gently tapering, not as long as width of front below; arista reddish with black apex and long black rays.

Thorax and abdomen metallic green, the latter more or less violaceous especially on apical half. Humeri and wing roots rusty yellow. Pile of thorax yellow; sparse, fairly long; bristles black; scutellum with deep apical depression.

Legs black, the femora sometimes largely metallic blue; tarsi brownish, at least basally; pile wholly black, short.

Wings cinereous hyaline; yellowish infuscate on apical half, the stigmal spot and spot at apex of marginal cell deeper brown. Marginal cell obtuse apically, extremely short petiolate or closed in the costa. Squamæ greyish with yellowish brown border and fringe; halteres white, the basal half yellow.

Abdomen clothed with short, erect yellowish white pile, the fifth segment wholly black pilose above and below. First abdominal segment and narrow base of second, brown.

Holotype— ♀, Tuipo, Panama, August, 1922, (J. P. Chapin).

Paratype— ♀, Cayuga, Guatemala, June, 1915, (Wm. Schaus).

Volucella tympanitis Fabricius

Syrphus tympanitis Fabr., Syst. Autl., 226, 1805.
Volucella ardua Wied., Auss. Zweifl., II, 204, 1830.

The type of *ardua* is a ♀ from Surinam and is certainly the same as *tympanitis* Fabr. In all the specimens of *tympanitis* I have seen the marginal cell is short petiolate but the scutellar depression places the species in the sub-genus *Phalacromyia*.

Volucella pallens Wiedemann.

V. pallens Wied., Auss. Zweifl., II, 204, 1830.
V. sexpunctata Lw., (Will.), Synopsis 141.

Type, a ♀ from Bahia, Brazil. The antennæ are missing. The mesonotum varies in color from rusty yellow to blackish, with the lateral margins and a transverse prescutellar spot pale yellow. A ♀ from Brazil and ♂ from Jamaica agree perfectly with the type. See Williston. The marginal cell is very short petiolate in the type, but varies to moderately widely open.

Volucella vaga Wiedemann.

V. vaga Wied., Auss. Zweifl., II, 205, 1830.

The type is a ♂ and is from the Winthem collection. Wiedemann had at least two specimens before him. A ♂ from Chapada, Brazil, agrees with the type except that the facial tubercle is slightly better developed and the apex of the middle femur is narrowly brownish. The front femur is wholly greenish or yellow. The width of the black stripe on the thorax varies considerably and it may or may not reach the scutellum, when not doing so being obtusely pointed behind.

Volucella discalis n. sp.

Allied to *pallens* Wied. but differing in having a less distinct preapical scutellar depression, which is shallow and coarsely granulate, large, broadly oval black scutellar spot covering most of the scutellum and black bristles on the thorax.

Length, 9 to 9.5 mm.

Male. Face and front translucent reddish yellow, the cheeks with a broad brown stripe reaching from the eye to the oral angles; median facial stripe black, broad, not nearly reaching the antennal base; in profile the face is deeply concave above, prominent and perpendicular below, produced strongly downwards as a long, slender cone. Frontal triangle small, the lunula triangular. Occiput dark above, greyish pollinose, yellow pilose; face with sparse yellow hairs, a few about the low tubercle black. Front with yellow hair on the sides, black on the middle line. Vertical triangle black, black pilose; occipital cilia black. Antennæ orange, the third segment broad, considerably narrowed to beyond the middle; arista reddish, the apex and long rays black. Eyes with black pile.

Thorax rusty yellow; the dorsum clothed with black hairs except along the sides and in front where the pile is finer and yellow. Scutellum black haired on the black or brown spot, elsewhere with yellow pile.

Legs reddish yellow, the broad apices of the tibiæ and the tarsi except basally, brownish. Legs with black hair except on broad bases of the femora.

Wings cinereous hyaline with faint luteous tinge. Squamæ brown, with paler base. Halteres white.

Abdomen pale rusty yellow, darker apically, the second and third segments each with a transverse brown spot on either side of the apex, the spots twice as long as wide, and with a more roundish black spot on the apex of the fourth segment at either side. Second segment with a small roundish apical brownish spot in the middle, the third with one near the base. Fifth sternite with large roundish brown spot at either side, the venter otherwise rusty yellow; genitalia reddish yellow. Abdominal pile black; finer and yellow on first segment and basal half of the second.

Female. Front rusty reddish on lower half, black above, lateral depressions long, deep. Frontal pile sparse, black. Often an oval brownish spot below root of wing. Fifth abdominal tergite black with a narrow rusty median vitta, the sternite black with broad pale median vitta, the fourth sternite also with black lateral spot. The spots on the abdomen are all shining black.

Holotype—♂, Grenada, Sept. 15, 1921, (August Busck); in the United States National Museum.

Allotype—♀, Grand Etang, Grenada, March, 1924, 1800 ft., (G. S. Millar).

Paratypes—2 ♀, same data as Holotype; ♀ same data as Allotype.

Volucella fracta n. sp.

Colored much as in *tricincta* Bigot but the abdomen chiefly violaceous brown, and the lateral scutellar depressions absent.

Length 8 mm. *Female.* Face translucent rusty yellow, with a narrow median brown stripe reaching over the tubercle and continuing narrowly along the oral margin to join the broader brown stripe on the front of the cheeks; a less distinct brownish spot below the eyes. Face deeply concave above, with a small prominent tubercle, the lower part prominent, moderately produced downwards as a short, sharp cone, the oral margin oblique. Lower fifth of the front brownish red, the remainder black, the lateral depressions black, moderately deep, fairly wide. Frontal pile sparse, whitish. Face broadly white pollinose below the antennæ, the posterior orbits grey pollinose and whitish pilose. Face with sparse yellow hairs. Eyes with enlarged facets on upper half which bear short yellowish pile. Antennæ orange, the third joint broad, scarcely tapering, gently concave above; arista with long black rays.

Thorax yellowish brown, the pectus and disc of the mesonotum darker, the latter with strong violaceous reflections; humeri pale yellow; notopleura and posterior calli luteous. Pile yellowish, sparse; bristles black. Scutellum large, rather transverse at apex, the corners rounded, the preapical depression deep. The disc of the thorax has a violaceous reflection and bears pale pile, the margin rusty brownish with black pile; a prescutellar band of black pile.

Legs castaneous, the first three tarsal segments brownish yellow; legs wholly black pilose.

Wings hyaline; an elongate stigmal spot, the crossveins at middle of wing and a small spot half way along the stigmal cell, brown; marginal cell broadly open. Squamæ brown, with greyish base; halteres pure white.

Abdomen violaceous brown, the first segment dull yellow; pile fine, short, erect, whitish; appressed and black on the apical half of the second and whole of the third segment except the sides.

Holotype—♀, Cayene, Fr. Guiana.

Volucella chalybescens Wied.

V. chalybescens Wd., Auss. Zweifl., II, 204, 1830.

This species is a *Phalacromyia* in the strict sense, having the lateral and apical scutellar depressions.

Length 8.5 mm. *Male.* Face translucent rusty yellow, the cheeks with a narrow, obscure brownish stripe reaching to the oral angles; front ferruginous. Face moderately concave above, the tubercle small, the face produced strongly downwards as a narrow acute cone; broadly white pollinose below the antennæ. Vertical triangle black pilose, the occipital cilia black. Face and front yellow pilose, the eyes with cinereous pile. Antennæ reddish; third joint broad, slightly tapering, gently concave in middle above; arista reddish, the rays black, long.

Thorax rusty yellow, the pectus and mesonotum except the broad sides ferruginous, the mesonotum with strong steel-blue reflections on the dark portion; pile yellow; a black pilose triangle in front of the scutellum. Scutellum violaceous brown, the corners and large preapical depression rusty reddish; the basal depressions wider than long, rounded apically, roughly punctured, without pile; the pile black, yellow on the sides, about four weak marginal bristles.

Legs reddish, tibiæ rusty brown, the tarsi becoming brown apically. Pile short, black.

Wings greyish hyaline, tinged with luteous anteriorly. Stigmal spot black, rectangular, the cell luteous. Marginal cell open. Squamæ tinged with brown, the fringe brown, the hairs separate. Halteres yellow with white knob.

Abdomen rusty reddish, the base much paler, the second and third segments with about the apical sixth shining black, the second with a brownish median projection extending three-fourths of the way to the base, and laterally the ferruginous color extends broadly forwards. Venter yellow, the fourth and fifth sternites darker. Pile pale yellow on basal pale area and venter, elsewhere blackish and suberect or erect.

There is no doubt about the single male being the type as it bears the label, "chalybescens, mihi, Amer. Merid." and is from Wiedemann's collection. Wiedemann states that the species is from Brazil, which may be erroneous. I have not seen the species except for the type and records of *chalybescens* are very doubtful.

Volucella spinigera Wiedemann.

V. spinigera Wied., Auss., Zweifl., II, 197, 1830.
Temnocera recta v. d. Wulp, Tijd. v. Ent., XXV, 125, 1882.
Phalacromyia. abrupta Curran, Ann. Mag. Nat. Hist., (9), Vol. XVI, 251, 1825.

Wiedemann's description of *spinosa* is rather misleading as the portion of the thorax he described as rich brown is luteous or dirty yellowish, sometimes rusty yellow, but hardly brown.

The number of bristles on the scutellum is usually eight, but the basal pair is quite small and seldom rises from a tubercle so that there are only six setigerous bristles in most cases. The number of short, stout prescutellar bristles also varies from four to nine, practically all of them contiguous at the base. The type before me is a ♀ from Montevidio, from the Winthem Collection.

Volucella macquarti n. sp.

Similar to *persimilis* Williston but the squamæ are wholly whitish, with whitish fringe, facial black stripe strongly developed, third antennal segment usually brown, longer and much more narrowed. The ♂ is more like *persimilis* as the squamæ have a narrow brown border and fringe; in *persimilis* the squamæ are dark brown on the apical half of the lower lobe.

Length, 10 to 11 mm. *Female.* Face pale yellow, whitish pollinose to above the antennal base; median facial stripe and broad anterior vitta of cheeks, shining black or brown; cheeks yellow; front shining blue-black, the lateral depressions rather deep, coarsely punctured, somewhat bronzed. Occiput grey pollinose, the upper fifth shining black; pile of head pale yellow except as follows: front except the sides on lower three-fourths and immediately above the antennæ, the middle of the face to upper edge of tubercle and the occipital cilia. Antennæ varying from brown to rusty dark red with the first two segments always dull reddish, the third segment broad basally, rather strongly tapering to the apical third, the apex but little more than half as wide as base; on the inner side below with a broad, elongate sensory depression (entirely wanting in *persimilis*); arista reddish with the apical half and very long rays black. Face moderately concave above, the tubercle large and rather prominent, the face slightly retreating below, produced moderately downwards as an obtuse cone.

Thorax black, the humeri, posterior calli and a line immediately above the wings, yellow or at least brownish red, the mesonotum and scutellum greenish opalescent with strong violaceous reflections; pile black, rather coarse, not abundant with yellowish pile intermixed and predominating laterally and in front, where, from posterior view there is a broad, geminate dark pilose stripe. Pile of pleura pallidly yellowish. Pleura rather variable in color as they may rarely be largely brownish on the anterior half, although as a rule only the propleura is brownish yellow; pleura thinly grey pollinose. Scutellum usually concolorous with the mesonotum but variable, often largely metallic reddish; pile on base yellow, fine, abundant, elsewhere long, sparse, black, but there is a broad, transverse, preapical bare area. Prescutellar bristles strong, 4 or 5 pairs; scutellum with 4 or 5 pairs of strong marginals.

Legs black; coxæ and femora posteriorly white pilose, the pile elsewhere coarser, black.

Wings luteous on basal half, elsewhere strongly infuscated, broadly greyish behind, the middle of the cells often paler. Marginal cell tapering

apically and long petiolate. Squamæ whitish with pale fringe. Halteres pale yellow, the knob white.

Abdomen shining black, the second segment pale yellowish with the broad posterior margin, and moderately broad median vitta, dull black, the black posterior band gently concave in front on either side of the middle. Third and fourth segment with a broad basal band of whitish pile, beneath which is a more or less distinct dark reddish fascia, that on the fourth segment much broadened laterally; fifth segment with the basal angles white pilose. First and basal half of second segment fine white pilose, the pile elsewhere coarser, black. Apical three sternites black, with paler triangles in basal angles, the basal segments with a median black vitta which broadens behind, the pile white except on the apical sternite.

Male. Frontal triangle brown; thinly pollinose, black pilose; vertical triangle black, black pilose; eyes with cinereous pile above. Pleura rather brownish yellow in front of wings. Second and third abdominal segments yellowish, the second with narrow brownish apex, the third with broad blackish apex. Squamæ whitish with pale brown border and fringe.

Holotype— ♀, Prieta, Honduras, April 5, 1924, (Dr. Jos. Bequært).

Allotype— ♂, Tehuantipec, (Sumichrast).

Paratypes— ♀, Trinidad, (Busck); ♀, Mexico, (Townsend); ♀, Tehuantipec, (Sumichrast); ♀, Kartabo, British Guiana.

Volucella dorsalis Wiedemann.

V. dorsalis Wied., Auss. Zweifl., II, 199, 1830.

Type ♂, from Wiedemann collection in Vienna Museum.

Length, 12 mm. Face rusty yellowish, except the large low tubercle, pale yellowish pollinose, the cheeks brown with a broad yellow stripe in front of middle; facial pile pale yellowish, yellow on the tubercle, longer laterally. Face shallowly concave above, slightly more prominent below, produced downwards as a moderately obtuse cone. Frontal triangle rusty reddish on anterior two-fifths, blackish above; similarly pollinose to face except anteriorly, the pile wholly black; the triangle prominent, slightly swollen, gently convex. Vertical triangle black, black pilose. Eyes tawny pilose. Antennæ reddish; third joint slightly narrowed to apical third, moderately wide, the apex obtuse; arista reddish, the apex and long plumes black. Occiput grey pollinose and yellow pilose.

Mesonotum deep watery green with strong purplish opalescence; humeri, posterior calli, a lateral stripe above the wings and the pleura posteriorly reddish; mesonotum with longish, fine yellow pile among which are shorter, coarser, black hairs which predominate posteriorly; a row of three (or four) pairs of strong black prescutellars; pleura rather ochreous pollinose; yellow pilose, with conspicuous black pile beneath

the wing-root. Scutellum large, gently convex, yellow, the lateral pile and ventral fringe yellow, the dorsum with longish black hairs except on a preapical transverse spot where the pile is replaced by extremely short, black hairs.

Legs blackish, the tibiæ brownish, the knees reddish, pile wholly black, including the coxæ.

Wings pale luteous, becoming greyish hyaline behind; the stigma scarcely darker, without basal spot. Squamæ whitish with bright yellow border and fringe. Halteres yellow, the knob white.

Abdomen pale rusty yellow, darker apically; with a broad median brownish black vitta extending from the base almost to the apex of the third segment and narrowly interrupted along the apex of the second. Pile of first two segments fine, yellow except on the narrow posterior and lateral margins of the second, elsewhere coarser, black. Broad middle of the venter and genitalia black pilose.

This species was omitted from the Kertesz Catalogue. I know of no reference to it other than the original description, which was very brief.

Volucella macula Wiedemann.

V. macula Wied., Auss. Zweifl., II, 200, 1830.

The type is a ♀ from Brazil and is slightly teneral. The species varies considerably in the extent of metallic violaceous coloring on the mesonotum which may be dark except the sides or wholly pale with only very slight traces of three darker vittæ. The mesonotum and scutellum are wholly black haired, while only the pale yellow base of the abdomen bears fine, yellow pile. Wiedemann's description covers all essential points. *Volucella cyanescens* Macq. appears to have a more sharply conical face but is very similar in most respects.

Volucella picta Wiedemann.

V. picta Wied., Auss. Zweifl., II, 201, 1830.

Type ♂ from Wiedemann's collection. The color of the abdomen is quite variable but the species is readily recognized by the large, obscurely rounded scutellum which bears abundant long black pile on the apical three-fifths, the oval white spot on the mesopleura above, spot above front coxæ and pale basal half of hind femora. It is probable that most of the North American references to *V. picta* refer to *pusilla* Macq. which is very similar but has a strong black facial stripe, and white squamæ, these being chiefly brown in both sexes of *picta*. *Pusilla* also has only the narrow base of the femora reddish.

Volucella timberlakei n. sp.

Allied to *picta* and *pusilla*. Differs from both in lacking a whitish spot on the mesopleura and in having reddish-brown to brownish red legs with the first two tarsal segments pale yellow; pile of legs long, abundant, black, pale on basal third of posterior femora, white on first two tarsal segments. There is a single, transverse, prescutellar yellow spot; the squamæ are pale yellow. The face has a brown or ferruginous median vitta which extends over the front in the ♀. The transverse basal fascia on the second abdominal segment is broad so that this segment is much more extensively pale than in *pusilla*, while the first segment is wholly pale in *picta* and there is no black incisure.

Holotype—♂, *Allotype*—♀, Texas, No. 1546 in the Canadian National Collection, Ottawa.

Paratypes—♂, ♀, Texas. One of the ♀ was given to the author several years ago by Mr. P. H. Timberlake, who collected it at Brownsville.

Volucella imitans n. sp.

Similar to *V. pusilla* from which it differs by having the scutellum entirely densely yellow pilose, lacking the yellow mesopleural spot, presence of a single, semicircular prescutellar spot and broader facial stripe.

Holotype—♂, Mexico.

It is possible that one of these is *V. pulchripes* Bigot but the description does not permit of determination and Bigot's species might be almost any belonging to the group. As the abdomen is usually variable in color except for the first two segments a description of this part is therefore not reliable.

Volucella unipunctata n. sp.

Related to *V. picta*, etc., but the legs are reddish as in *V. ornata* Willist. from which it differs in the chiefly black pilose mesonotum.

Length, 7 to 8 mm. *Male*. Face whitish yellow, the cheeks, oral border and entire median facial vitta, shining black, the frontal triangle small, pale yellow, with the lunula black, the pile also black. Posterior orbits grey pollinose. Vertical triangle black; together with the eyes, black pilose, the pile on the occiput and face, whitish. Antennæ brown or brownish red, the basal joints darker; arista ferruginous, the rays long.

Thorax shining black, the mesonotum broadly whitish laterally in front of the suture, and with a vitta above the lateral margin extending from the suture to the posterior calli; also a small sub-triangular prescutellar spot. Mesopleura over half whitish, a smaller spot above the front coxæ. Pile of mesonotum fairly long, black behind the suture,

cinereous in front and on the pleura except below the wings where there is a black patch. Scutellum translucent yellowish, with a yellow spot on either side, the yellow spots yellow pilose, the pile elsewhere longer, more abundant, black.

Legs rusty reddish, the tips of the tibiæ and last three tarsal segments brown; first two tarsal segments yellow. Pile of legs black, fairly long on the tibiæ, pale on the bases of the posterior four femora and the first tarsal segment.

Wings hyaline with five short brown fasciæ, the first extending from the first vein over the second basal crossvein, the second from the stigma over the first basal crossvein; third from half way along the stigmal cell to the apex of the discal cell, fourth from apex of marginal cell over anterior half of apical crossvein, the fifth running slightly along the tip of the third vein. Squamæ greyish, with infuscation inwardly on the lower lobe, the fringe yellowish but becoming fuscous inwardly. Halteres yellow, with white knob.

Abdomen yellow and shining black, the markings unusually constant. First segment black; the second black with a pair of large, crescentric yellow spots which broaden laterally to reach the base broadly but are widely separated from the hind margin. Third segment with the basal two-thirds reddish yellow, separated in the middle by a narrow black stripe and narrowly from the lateral margins, the yellow spots shallowly concave behind. Fourth segment similar but the spots not concave posteriorly and the segmental apex is reddish. Pile yellow, but black on the posterior half of the second and whole of the third segment except the narrow lateral margins. Venter yellow with a broad median black stripe which is interrupted on the basal three-fourths of the third segment and expanded over the whole of the fifth segment. Genitalia black.

Female. Front yellow, with broad median brown vitta which is narrowed to the ocellar triangle. Frontal pile black; yellow laterally on lower third. Fifth abdominal segment wholly black.

Holotype—♂, Desecheot Island, West Indies, Feb. 18–20, 1914, in American Museum of Natural History.

Allotype—♀, same data.

Paratypes—3 ♂, 1 ♀, same data; 1 ♀, Ensenada, Porto Rico, June 14–19, 1915. Paratype No. 1547 in the Canadian National Collection.

Volucella abdominalis Wiedemann.

V. abdominalis Wied., Auss. Zweifl., II, 196, 1830.

Length, 16 mm. *Male.* Face and frontal triangle pale yellow, wholly covered with very pale yellow pollen except the lunula; cheeks shining brownish black. Vertical triangle yellow, the ocellar tubercle wine-red. Head yellowish pilose, the eyes cinereous pilose above. Antennæ reddish, the third segment strongly concave above, obtuse and broader apically than at base. Arista reddish, the apex and long rays, black.

Face with long, low tubercle, moderately concave above, produced downwards and slightly forwards as long, slender cone.

Mesonotum shining blackish, the broad lateral margins and a broad prescutellar transverse spot narrowly joined behind to the pale margins, yellow, the yellow extending as a narrow line along the suture; scutellum yellowish; pile yellow; no bristles on thorax or scutellum. Pleura black, and clothed with black pile.

Femora, apices of tibiæ and the tarsi, blackish brown, the tibiæ and tips of the femora, reddish. Legs, black haired.

Wings yellowish on basal half or more in front, hyaline apically and on posterior half, the stigmal cell yellow, the cross-veins clouded with brown. Marginal cell scarcely widened before the end, long petiolate. Squamæ pale yellow, with dense, compact yellow fringe. Halteres reddish with white knob.

Abdomen brownish violaceous, entirely clothed with short, stiff, appressed black hairs.

Redescription of type in Vienna Museum, Cuba, Wiedemann collection.

This species has been reported from Jamaica in addition to Cuba but the former reference probably refers to *eugenia* Willist.

Volucella lugens Wied.

V. lugens Wied., Auss. Zweifl., II, 206, 1830.

It is doubtful if any references to *lugens* from Central America actually refer to this species, which bears a close resemblance to *vaga* and *mus*. *V. lugens* Will., from Central America is a different species.

Length, 9.5 mm. *Female.* Face rusty yellow, with a median black stripe reaching quite to the antennæ and somewhat narrowed above the tubercle; cheeks brown on posterior half and with a broad brown stripe extending from the oral angles to the eye; face apparently without pollen; in profile deeply concave above, the tubercle small but conspicuous, the lower portion of the face prominent, produced downwards as an acute cone. Front wholly shining black, the lateral depressions narrow, tapering above, not deep. Occiput grey pollinose, yellow in ground color below. Front wholly short black pilose; face and occiput with yellowish pile; eyes evidently bare. Antennæ reddish; third joint broad, slightly tapering, not concave; arista reddish, the apex and long rays black.

Thorax rusty yellow or reddish, the mesonotum shining blue-black except on the very broad sides, less widely so in front of the suture, but evidently variable, the black reaching the scutellum in full width; pectus brownish. Thorax yellow pilose, the mesonotum evidently with numerous scattered black hairs on posterior half. Scutellum convex, violaceous brown, the base and apical margin yellow; wholly black pilose and with three pairs of strong bristles. I am not certain that there is not a row of fine prescutellars but as the mesonotum is largely denuded it is not possible to be certain.

Legs black, the femora reddish brown; pile wholly short, black.

Wings hyaline basally, becoming fuscous on apical third, especially anteriorly. Marginal cell with extremely short petiole. Squamæ brownish tinged, with fringe of isolated brown plumes. Halteres yellow with whitish knob.

Basal two-thirds of second and whole of first abdominal segment pale yellow, the anterior margin of the black on second segment concave on each side near the middle line and oblique at the sides where the yellow narrowly reaches the hind margin. Third and fourth segments shining black, each with a broad reddish fascia which is broadly interrupted in the middle, widest sub-laterally and reaching the side margins in half its width in front. Pile yellow on basal pale area, elsewhere black, short. Venter yellow, with the apical two-thirds of the last three segments black, the bases reddish.

The type is a ♀ from the Winthem collection and is in only fair condition. I suspect that the femora are normally reddish and that there are prescutellars although they must be weak. If they are assumed to be present, the species would trace out to *macquarti* which has, however, a broad median black vitta on the second abdominal segment.

RECONSIDERATION OF SOME POINTS IN THE MORPHOLOGY OF THE HEAD OF HOMOPTERA.

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A great deal has been written about the morphology of the head of Hemiptera, and the Cicada has been the type chiefly used. That there are points upon which there are very divergent opinions is shown by Snodgrass' very valuable criticism*, where some of the difficulties that confront the investigators are well set forth. This constructive criticism is a type of work far too scarce in American entomological literature and our science would be the better for more of it.

Comstock, in his "Introduction to Entomology," has presented an interpretation which is accepted by a number of workers, but which the writer considers is not well sustained by facts, especially that dealing with the mandibular sclerite.

In 1911 and 1912 the writer in collaboration with J. C. Kershaw† published on this subject, but they unfortunately went astray in identifying the arms of the tentorium. The recognition of this fact has caused the writer to reconsider the matter, and the new interpretation arrived at appears to throw fresh light upon the subject and removes certain objections raised by Snodgrass.

The present work was mainly done on the head of *Melampsalta* sp. in its last nymphal stage. The specimens were kindly supplied to me by Dr. J. G. Myers of New Zealand, as there are no Cicadidæ in Hawaii.

In the head of this nymph the labium is carried projecting forward at an angle with the clypeus and frons, and not nearly in a line with them as in the adult. Four distinct sutures can be distinguished on each side of the head, (Fig. 1, a, b, c, d).

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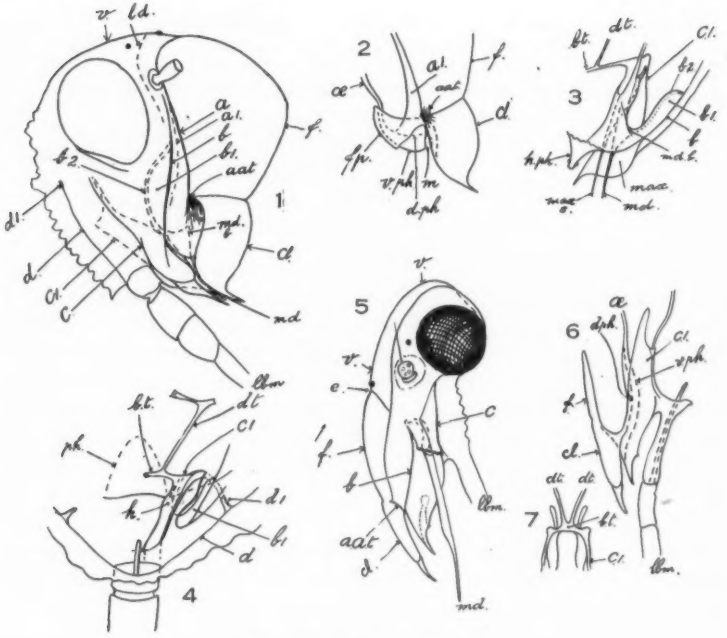
*Pro. Ent. Soc. Wash. 23 (1) pp. 1–15, Figs. 1–15, (1921).

†F. Muir and J. C. Kershaw, 1911, Psyche XVIII, pp. 1–12, pp. 75–79, 1912, Psyche XIX, p. 77–89.



EXPLANATION OF LETTERING.

a.....Frontal suture.
a. a. t..Origin of anterior arm of tentorium.
a. l.....Apodeme of frontal suture.
b.....Genal suture.
b. t.....Body of tentorium.
b. l.....Apodeme of genal suture.
b. 2.....Thickened wall of genal apodeme.
c.....Maxillary suture.
cl.....Clypeus, clypeo—labrum or labrum.
c. l.....Maxillary apodeme.
d.....Labial suture.
d. ph...Dorsal wall of pharynx.
d. t.....Dorsal arm of tentorium.
d. l.....Apodeme of labial suture.
e.....Junction of vertex and frons.
f.....Frons or clypeo-frons.
f. p.....Frontal plate of tentorium.
h.....Crescent shape sclerite.
h. ph...Hypopharynx.
lbm.....Labium.
ld.....Line of dehiscence at ecdysis.
m.....Mouth of pharynx.
max....Maxillary.
max. s..Maxillary seta.
md.....Mandible.
md. s...Base of Mandible.
œ.....Oesophagus.
ph.....Pharynx.
v.....Vertex.
v. ph...Ventral plate of pharynx.

EXPLANATION OF FIGURES.

Fig. 1. Lateral view of head of *Melampsalta* sp. at last nymphal stage.
Fig. 2. Ditto, pharynx with support formed by frontal plate of tentorium.
Fig. 3. Maxillary apodeme with setæ viewed from dorsal aspect.
Fig. 4. Maxillary apodeme, viewed from ventral aspect.
Fig. 5. Lateral view of head of *Mnemosyne bergi* with free maxillary sclerite cut away.
Fig. 6. Lateral view of maxillary apodeme, cl, lbm. and ph. of *Mnemosyne bergi*.
Fig. 7. Full view of apex of maxillary apodeme, and body of tentorium of *Mnemosyne bergi*.

The Frontal Sutures: (a) These delimit the lateral extent of the frons and they continue beyond the antennæ, curving and meeting together in the middle line. The area so delimited represents the frons, or perhaps the frons and clypeus. On account of this uncertainty it was called by Kershaw and Muir the "clypeal region." Internally the frontal suture forms a flange-like apodeme, narrow near the antenna and widening apically till it reaches the junction of the frons and clypeus, where it invaginates, flattens out and joins the one from the opposite side, (Figs. 1, 2, al) thus forming a plate which appears to be homologous to the frontal plate of the tentorium of some orthoptera, (Fig. 2, f. p.). This frontal plate forms the support of the posterior half of the pharynx. The invagination (Fig. 1, a. a. t.) forming this frontal plate is similar in position to that forming the anterior arms of the tentorium in other orders. The area bounded by the frontal sutures appears, therefore to be the frons (or frons and clypeus) and this idea is supported by the fact that the pharyngial muscles are attached to it, a point made by Snodgrass. Has not Snodgrass fallen into the same error in the honey bee, for his clypeus appears to be morphologically the same as this area and the muscles from the pharynx are attached to it.

The pharynx itself is membraneous with a strengthening rod of chitin, the ventral wall being fastened to the frontal plate. In a nymph just after ecdysis, before the chitin has hardened, the pharynx can be separated from the frontal plate of tentorium (Fig. 2, f. p., v. p. h.). Along the medio-longitudinal line of the dorsal wall of the pharynx arise a number of long, thin apodemes to which the thin, fan-like sheets of muscles are attached, the outer edges of these muscles being attached to the transverse ridges of the frons. It is questionable whether the elasticity of the dorsal wall of the pharynx is responsible for the closing of the pharynx; the median apodemes are long and strong enough to allow of muscular action in both directions.

Clypeus, Labrum: The exact composition of the portion marked cl. (Fig. 1), is left in doubt, for it may be the clypeus, clypeus plus labrum or labrum.

The genal suture: (Fig. 1, b). This is behind the frontal suture to which, posteriorly, it is approximate. The area bounded by the frontal and genal sutures is called the mandibular sclerite, or lora. The author considers it to be homologous with the gena of other orders, or with a part of that area. Interiorly this suture forms a deep flange-like apodeme (b. 1), arcuate along its inner margin where it is considerably thickened (b. 2); anteriorly it joins with the apodeme from the opposite side and forms the anterior support for the ventral wall of the pharynx. Like all such apodemes, it is formed by a double wall which is membraneous except along the bottom, where it forms a thin chitin rod (b. 2). The dorsal arm of the tentorium arises from near this suture where it approaches the antenna; it joins the tentorial body near the middle.

*Anatomy and physiology of the Honeybee (1925), Fig. 18, p. 58.

The mandibles: The base of the mandible (Figs. 1 and 3, md. b.) lies between the anterior end of the genal apodeme and the origin of the anterior arm of the tentorium, the distal end of the gena covering the base of the mandible. The outer corner of the base of the mandible is attached to the rod-like thickening at the bottom of the genal apodeme, (b. 2) and it is to this thickened portion that the protractor muscles of the mandible are attached, the opposite end being attached to the inner surface of the gena and to the apodeme supporting the pharynx. The retractor muscles of the mandible are attached to the head capsule beyond the origin of the dorsal arm of the tentorium.

The genæ: The sclerite between the frontal and genal sutures is the most controverted sclerites of the head of Hemiptera. J. B. Smith in 1892 stated that it was a portion of the mandible similar to the maxillary sclerite. This idea has been accepted by several workers, including Comstock. If we inquire into the evidence for this interpretation we can find none. The mandibles in Hemiptera arise in the embryo as a simple bud, as they do in all mandibular insects; we can follow them from the earliest beginning up to the adult stage and at no time do they show any signs of a division. The probabilities of a mandible dividing into two portions and one portion (evidently the basal) amalgamating with the head while the distal portion takes up a new position with new articulations, apodemes and muscles, is so very improbable that morphologists should not accept it unless very convincing evidence can be produced. There are several valid reasons for regarding this sclerite as the gena, or part of the gena. The position on each side of the frons and clypeus naturally suggests it; the position of the opening of the anterior arms of the tentorium; the position of the frontal sutures, the support given to the pharynx; the position of the mandibles; the attachment of the protruder muscles of the mandibles. After a reconsideration of the question, the writer comes to the same conclusion as he did when working with Kershaw, viz., that this sclerite is not composed of a part of the mandible; now he further concludes that it is the gena or portion thereof of normal mandibulate insects.

The maxillary suture: (c) Except anteriorly this suture is very indistinct and it is only recognizable as a crease. The region between the genal and maxillary suture is the maxillary plate and that portion of the head capsule to which it is fused. The division of the maxillary into the maxillary plate and seta has been demonstrated by embryological studies. The anterior portion of the maxillary plate projects as a free appendage, meeting the labrum beyond the gena and closing the gap there due to the reduction of the mandible and its internal position; the pointed apex meets that of the opposite maxillary plate below the hypopharynx and, together with the pointed labrum (or epipharynx), form a small opening through which the setæ pass. At the base of the free, apical portion of the maxillary plate on the under side, is the opening of the deep invagination which forms the large maxillary apodeme (cl.). It is the most complex and conspicuous structure in the head of the Cicada. The genal suture joins it and they form a pouch in which the mandible and the maxillary setæ lie. The

base of the maxillary seta is carried further back than the base of the mandible. The apices of the maxillary apodemes are joined by a thin bridge (body of tentorium, bt.) and it is to this that the dorsal arms of the tentorium are joined (Figs. 3, 4, bt.). The "crescent-shaped sclerite"* is a thickening of the wall of this apodeme, (Fig. 4, *h*).

The labial suture: (d) This is very ill defined and forms only a crease, but its position is defined by the invagination (Figs. 1, 2, dl.) which in the nymph is joined to the apex of the maxillary apodeme by cellular structure, but which, in the adult, is joined by a chitinous connection. It is possible that this is the posterior arm of the tentorium of other insects.

This may not quite agree with the accepted arrangement of the tentorium but that question must be postponed till another occasion. The tentorium is regarded by some morphologists as representing ancient tracheæ. The writer would suggest that they represent the segmental apodemes and that they arise at the edge of the segments composing the head. In this case there are four pairs of invaginations.

The above interpretation does away with various of the "morphological absurdities" justly complained of by Snodgrass, and it shows that the departure from the normal mandibular head is not very great.

The chief of these departures are:

The flattening of the head so that the maxillaries are visible at the sides in frontal view.

The reduction of the width of the mandible and its withdrawal into the head capsule with the closure of the gap between the maxillary and clypeus (or labrum).

The sutures with their large apodemes, either flange-like or long and complex.

The fusion of part of the maxillary with the head capsule and the withdrawal of the setæ into the maxillary pouch.

The bringing together of the setæ so as to form a continuous tube with the pharynx.

Considerable changes take place at the last ecdysis so that it is not easy to understand the origin of some of the structures without watching the ontogeny.

The following are some of the chief changes.

The great increase of the size of the maxillary apodeme and the amalgamation of its apex with the labial apodeme, together

*Comstock. Introduction to Entomology (1924), p. 399, fig. 465 ca; marked *H* in Snodgrass' figures.

with the filling up of the space between, except for two holes through which muscles pass into the neck. The greater portion of the ventral surface of this apodeme serves for the attachment of the muscles which work the salivary pump which has two large, flat apodemes to which the muscles are attached. The great enlargement of the apodemes of the frontal and genal sutures; in the latter the chitinization increases and the membraneous portion breaks down, or is difficult to recognize, leaving a wide apodeme from the base of the mandible to the head capsule near the opening of the dorsal arm of tentorium. Unless the origin of this structure is recognized it is impossible to understand the arrangement of the head capsule and the mouth parts, and the failure to recognize it has led to the idea that the mandibles arise far back in the head capsule. Such a head as Meek figures and Comstock* reproduces gives a totally wrong impression.

The heads of all the families of Cicadoidea are very similar in build. The Membracidæ appear to have one characteristic different from all the others, and that is the frons overlaps the base of, and often entirely hides, the clypeus (or labrum). This character is not found in *Aethalion*† which, along with the absence of an intestinal filter, separates it from that family and places it near *Eurymelus*.

If we take the head of cixiid (i. e., *Mnemosyne bergi* Muir) as a representative fulgorid we can see that the head has been straightened or flattened out, the vertex enlarged and brought to the front, forming the "frons" of most systematists, with the median ocellus near its apex. By this development the antennæ are brought below the eyes and the lateral ocelli between them. The elongation of the frons causes the anterior portion of the head to be lengthened, the maxillary sclerites following in this line of development; the frontal suture is confined to the opening of the anterior arm of the tentorium which forms the support for the pharynx. The maxillary apodeme is long and joined together by the bridge to which the dorsal arms are attached. The labial suture and apodeme do not appear to be present (Figs. 5, 6, 7).

If we bend such a fulgorid head backward at the point of junction of the vertex and frons (Fig. 5, e) we can at once see

*Comstock. Introduction to Entomology, p. 398, f. 465.

the relationship with the Cicada. The Fulgoroidea are much more specialized than the Cicadoidea.

While there are a number of important points still unexplained, yet the foregoing notes appear to add to our knowledge of the morphology of the head of Hemiptera, and to eliminate some of the "morphological absurdities" that have rightly appeared so illogical to Snodgrass.

SOME "BITING" LEAFHOPPERS.

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The members of the family Cicadellidæ are commonly regarded as herbivorous since they are thought to depend entirely on plant juices for their food. It has been known for some time, however, that they will bite man. Riley and Johannsen, for example, mention *Platymetopius acutus* (Say) and *Empoasca mali* (LeB.) in this connection. The writer has frequently been told of such attacks and has himself been bitten a considerable number of times by these insects. At present most of us would probably ascribe this biting to causes other than the desire to get blood for food, and the question as to whether or not blood is actually ingested in such cases will require further observation. The persistence with which these insects sometimes bite, however, makes one wonder whether any other motive can satisfactorily explain their action.

The species most commonly reported as biting people is undoubtedly *Empoasca fabæ* (Harris), until recently called *Empoasca mali* (LeB.). The writer has often felt a bite on his hand when collecting under lights or when reading at night, and in most cases this has been the species involved. Others report being bitten by "a little light green bug" which is probably the above-mentioned species in most cases.

Professor Raymond H. Beamer recently reported being bitten by a leafhopper while working under a light. This specimen, which proved to be *Erythroneura basilaris* (Say), after biting in one place a while, moved a short distance and inserted

its beak, then moving once more inserted its beak for the third time, each time the bite being felt for several seconds. It was then caught for identification. Mr. E. M. Becton reports a similar experience with *Phlepsius irroratus* (Say). The persistence of the insects in such instances makes one wonder if they were not after blood.

In addition to these three species, the writer has been bitten, in each case when collecting at a light, by three other species. Each time the specimens were captured leaving no doubt as to the identity of the species concerned. The species involved were *Deltocephalus inimicus* (Say), *Dræculacephala mollipes* (Say) and *Euscelis obscurinervis* (Stal).

It may be of interest to mention here also a biting species recently sent the writer by Doctor Marshal Hertig from Hsuchowfu, Kiangsu, China. Doctor Hertig writes as follows regarding his experience: "Last night, June 7th, as I was reading, great numbers of various tiny insects, mostly Diptera together with the enclosed Jassids, were attracted to the light. Many of the Jassids alighted on the book and on other white surfaces, papers, my clothes, etc., and on my bare arm which was just under the light. Several times I thought I felt a pricking, but believing that Jassids wouldn't do such a thing, dismissed the idea as imagination. The apparent pricking whenever these insects rested on my arm, however, continued, and so I watched them with my hand lens. In practically every case, (half a dozen or so) after alighting, the proboscis appeared, they braced themselves for the thrust and the prick was felt. They would remain in this position for several minutes." This species, while not definitely determined, is a Deltocephalus, very close to our common *Deltocephalus striatus* (Linn.).

A CHAPTER IN THE LIFE HISTORY OF MORDWILKOJA VAGABUNDUS (APHIDIDÆ).

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In 1862 Walsh described an aphis under the name of *Brysocrypta vagabunda*, which had occurred very abundantly on various forest trees in September. Walsh gave this aphid the name vagabunda, meaning vagabond or wanderer because he knew nothing of its life habits having taken only the winged form and this on various hosts. Two years later or in 1864, Walsh associated the aphid causing a large irregular gall on the cotton wood with the aphid he had described as *Brysocrypta vagabunda*. Aphidologists since that time have generally followed Walsh in believeing that the form which he collected and described was the same as that causing the gall and the name vagabundus has therefore come to be associated with the gall form.

Oestlund 1887, first described the gall form, or spring migrant and pointed out that the species described by Walsh was evidently something else from that producing the gall, not knowing at that time of the occurrence of fall migrants. Oestlund, however, followed Walsh and Riley and other workers of that time in believing that the gall was more characteristic of the species than the forms themselves and, therefore, retained the name vagabundus. Oestlund's statement that the species described by Walsh was evidently something else than that produced in the gall, threw some doubt on the correctness of Walsh's belief. The discovery by the writers that the form described by Walsh was the fall migrant of the form produced in the gall removes all doubt from the assumption made by Walsh.

The attention of the writers was called to the fact that old galls of *Mordwilkoja vagabundus* often contained in the fall winged plant lice of a form differing from those which originally inhabited them.

It was thought that this was something unusual, and a number of old galls were at once investigated. Several living, and many dead individuals were found in the first lot examined.

They proved to be fall migrants. They differed from other Pemphiginæ known to the authors; naturally they were suspected of being the fall migrants of *M. vagabundus*. Walsh's description was examined for some possible clue. It was found that they agreed very well in size, with those of Walsh's description; the head and thorax likewise agreed very well, being black, shining and free from pulverulence. The forewing had what Walsh called an interior vein below the stigma and the length of the sixth antennal segment in comparison to that of the sum of four plus five was more nearly that given by Walsh, than that of the summer migrant. These factors together with the fact that they were collected in September during the time that Walsh says they were abundant, led us to believe that these forms could be no other than the fall migrants of *Mordwilkoja vagabundus*, the form from which Walsh drew his description.

Galls were again collected from a locality some distance from the first. These galls were also inhabited; this time the dwarf beakless oviparous females which had doubtless been over-looked in the first material brought in, were found. This was on September twenty-second. More galls were collected on September twenty-seventh from the same locality as the second lot. The oviparous females were more numerous and somewhat larger, due, no doubt, to the maturation of the eggs which were now much larger. No males were found. No more material was collected until October tenth, when one gall was brought into the laboratory. Several males were present, and one was observed in copulation with a female. Eggs were also discovered at this time. The last collection of material was made October seventeenth; eggs, a few males and many oviparous females were found at this time. No live migrants were present in the galls although their dead bodies were very abundant. No attempt was made to count the number of migrants in a gall but a conservative estimate would place the number around thirty in some large galls. The fact that no males were found until October seventeenth would seem to indicate that the migrants which give birth to them return to the galls later than those which deposit the oviparous females.

It is of more than ordinary interest from a biological viewpoint to know that aphids removed by from three to six generations from the ones which left the galls early in the summer return to the homes of their ancestors after developing upon

some unknown host. In these old galls the fall migrants deposit the sexual forms. The females after fertilization deposit the eggs in the beds of down in small crevices on the inside wall of the gall. The eggs remain here until spring well protected from the elements, spiders and coccinellids. The fact that the eggs are laid in the old galls explains why the same trees in a given locality are year after year infested with this species; while trees near by are apparently immune to their attack.

Description of the fall migrant. This form is very unlike the spring migrant. The presence of large wax pores on the head separate this form at once from the spring migrant and other Pemphiginæ known to the authors. The spur of the sixth antennal segment in contrast to that of the spring migrant is short. The wings are much larger, and there is what we may call a supplementary vein below the stigma.

Length, 4 mm.; length of fore-wing, 4 mm. Head black shining, free from pulverulence. Antennæ brownish-black, six segmented, nearly reaching the abdomen. Proportional lengths of antennal segments as follows: I 5; II 8; III 24; IV 8; V 9; VI 16. Secondary sensoria transverse, arranged in a single row, on segments III and IV. No sensoria encircling the segments, a few shorter than the diameter of the joints, arranged as follows: III, 11–18, most common number, 16; IV, 2–4, most common number, 3, grouped together at the apical end of the segment. Primary sensoria on joints V and VI large, fringed with hair, the rim of the sensorium on the sixth segment carries four secondary sensoria arranged in pairs, the spur of the sixth joint carries six sensilla, and is from one-fourth to one-third the length of the segment. The total length of the sixth segment compared with the length of the third varies from slightly less than two-thirds to two-thirds the length of the same. Rostrum long, four-segmented, reaching almost to the base of the metathoracic coxæ. Last segment shorter than the tarsi of the hind pair of legs.

Thorax black shining, almost free from pulverulence. Legs long, blackish-brown; in well cleared specimens sensoria may be seen at the basal and apical ends of all femora. The fore and hind wings are large. The stigma of the fore wing is rather long and smoky; the radial sector arises rather far back on the stigma. The media is simple, the basal portion is missing. The cubital and anal veins are well developed, visible throughout their length. The veins of the hind wing arise triradiately, number of hooks variable, ranging from four to seven.

The color of the abdomen is a dusky greenish-yellow rather thickly covered with pulverulence which gives to it a greyish tinge. Cornicles absent. Cauda short and rounded, bearing two hairs on its dorsal surface some distance from the tip. Anal plate rounded, well supplied with hair. Both cauda and anal plate darker than the rest of the body.

Form and distribution of waxpores. Waxpores consisting of many, usually six-sided facets. Two waxpores are found on the head near the basal portion; one on each side of the median line. Two small pores

are present on the lateral portions of the prothorax, and four on the tergum of the same, the two smaller median pores on the tergum being slightly in front and between the two larger. The tergum of the mesothorax carries two well developed pores. The first seven abdominal segments are supplied with two waxpores each, on the lateral margins between and just above the spiracles. The first three segments carry in addition to these, two rows of waxpores on the tergum; these have on the fourth segment united into one. Very much smaller pores have been observed at the sides of the dorsal pores on the first two abdominal segments, and a single pore has also been seen on the fifth segment just below that on the fourth; these are, however, not constant. The eighth segment carries a large, somewhat irregular transverse waxpore which reaches almost to the lateral sides of the abdomen.

The host plant upon which this form develops is not known, when it is discovered the final chapter of the life history of this very interesting aphid will be written. The large well developed waxpores on the head and thorax would seem to indicate that it develops upon the roots of some plant, probably a grass.

Description of the oviparous female. Length, 1.20 mm. Head golden yellow. Antennæ light dusky, five segmented; segments indistinctly separated from one another. Proportional lengths of segments as follows: I 10; II 10; III 8; IV 7; V 4. There are no secondary sensoria. The fifth segment carries a very poorly developed primary sensorium. The primary sensorium on the fourth segment is not apparent. The antennæ are longer than the distance between the eyes. The rostrum is wanting. Eyes brownish, three faceted. Thorax golden-yellow, legs short and thick, the segments being very wide. Tarsi one-half the length of the distance between the antennæ. Abdomen same color as the head and thorax. Cornicles not present, cauda short and rounded, anal plate the same. The egg extending well up into the thorax, gives to that portion of the body in which it lies a creamy color. Two waxpores are found on each side of the abdomen near the posterior end. They do not seem to function until a day or two before the egg is to be layed and then only after the oviparous female has secreted herself in a small crevice or other small opening, preferably one formed by one of the "pimples" on the outside of the gall.

Description of the egg. The egg is .8 mm. long, elongate oval in shape and free from all ornamentation. When first layed the eggs are creamy-white in color, which soon changes to a rich golden-brown, which after some time changes to black. They are completely surrounded by the thread-like pulverulence secreted by the waxpores which fills the cavity in which they are located. In many cases the body of the female may be found near the egg entangled in the strands of pulverulence.

Description of the male. Length .86 mm. Head dusky yellow. Antennæ five-segmented; proportional lengths of segments as follows: I 10; II 13; III 6; IV 8; V 20. There are no secondary sensoria.

The fifth segment carries a poorly developed primary sensorium. The length of the antennæ is subequal to the distance between the eyes. The rostrum is wanting. The eyes are brownish, three faceted. The legs are dusky-yellow, short, and have the joints thick. Tarsi not counting the claws shorter than the femora, are wide at the middle. The abdomen is golden-yellow. Cornicles absent. Cauda and anal plate rounded. Waxpores not apparent. The claspers are curved, rather strongly chitinized, and longer than the tarsi. The tip end of the abdomen is sometimes bent forward underneath the rest of the abdomen.

For the convenience of those who may not have access to the original description of *M. vagabundus;* Walsh's description is given here.

"*Byroscrypta vagabunda* n. sp.—Black, polished, with no appearance of pruinescence. Antennæ and legs dull fuscous. Abdomen and venter obscure opaque-yellowish, varied with fuscous or sometimes with brown. Wings subhyaline with a whitish tinge, costal and subcostal veins and one-third of the inner edge of the wing from the tip of the first discoidal to the base of the wing, conspicuously fuscous; the remaining veins in both wings whitish hyaline; costa slightly tinged with brown, stigma pale fuscous-brown, its interior vein thickened. Alar expanse .43–51 inch.

"Eleven specimens. The 6th joint of the antennæ is two-thirds as long as 4 and 5 put together; and the stigma is 3½ times as long as wide, very acutely pointed at both ends. Three or four specimens have a little white pruinescence still attached to their wings. Occurred very abundantly on various forest trees in September. This is the largest known N. A. species either of this or the following genus, *P. Pyri* expanding only .38 inch. That species is distinguished at once from *vagabunda* by its wing-veins being all black."

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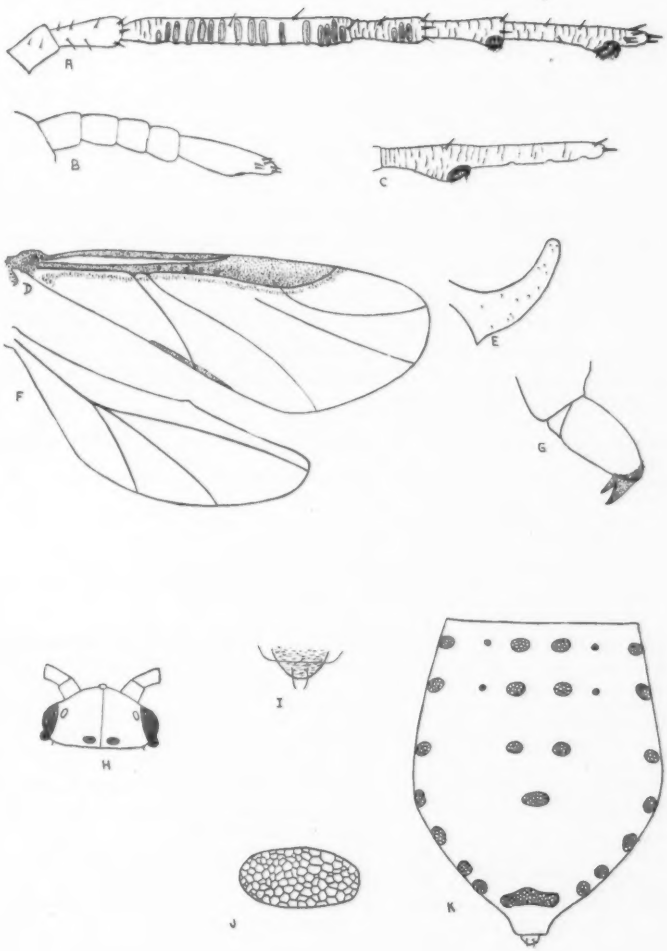
EXPLANATION OF PLATE VI.

A—Antenna of fall migrant.
B—Antenna of oviparous female.
C—Spur of Sixth Antennal segment of spring migrant.
D—Forewing of fall migrant.
E—Clasper of male.
F—Hind wing of fall migrant.
G—Tarsis of male.
H—Head of fall migrant.
I—Cauda of fall migrant.
J—Waxpore of fall migrant.
K—Abdomen of fall migrant showing distribution of waxpores.



Oestlund and Hottes.

AFRICAN SYRPHIDÆ COLLECTED BY J. C. BRIDWELL.

C. Howard Curran and E. H. Bryan, Jr.

The following species of Syrphid flies have been identified in a collection made in South Africa and Nigeria by Mr. John Colburn Bridwell in 1914, and on deposit in the Bishop Museum, Honolulu. One species of Graptomyza is here described as new. The bulk of the material was collected by Mr. Bridwell at Olekemeji, Ibadan, Nigeria, and at Cape Town. The former locality will be here referred to as Nigeria. In addition there is one specimen each from East London and Sierra Leone. The page references given in parenthesis are to Bezzi, Syrphidæ of the Ethiopian Region, British Museum, London, 1915.

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Protylocera aesacus (Walker). (Bezzi, p. 62). Nigeria.
Phytomia curta (Loew). (Bezzi, p. 73). Nigeria.
Phytomia incisa (Wiedemann). (Bezzi, p. 76). Cape Town.
Lathyrophthalmus sp. n. Cape Town.
Eristalodes plurivittatus (Macquart). (Bezzi, p. 88). Nigeria.
Eristalis tenax (Linnaeus). (Bezzi, p. 93). Cape Town.
Helophilus (Mesembrius) strigilatus Bezzi, (p. 96). Nigeria.
Mallota pachymera Bezzi (p. 99). Cape Town.
Syritta spinigera Loew. (Bezzi, p. 105). Cape Town.
Syritta stigmatica Loew. (Bezzi, p. 106). Nigeria.
Eumerus lunatus (Fabricius). Cape Town.
Eumerus feæ (?) Bezzi, (p. 115). Nigeria.
Eumerus obliquus (Fabricius). (Bezzi, p. 116). Nigeria and Cape Town.
Eumerus spp. n. Cape Town.
Cerioides pulchra Herve-Bazin. (Bezzi, p. 139). Nigeria.

Graptomyza mitis new species.

Face, lower part of front, margin of thorax and abdomen shining translucent yellowish; wings with brown markings on apical two-thirds.

Length, 5 to 5.5 mm. *Female.* Cheeks concolorous with face or with a triangular brownish area below the anterior edge of the eye; upper half of face not more prominent than edge of eye, the lower half decidedly more prominent than the antennal base, its upper portion forming a fairly large roundish tubercle, below which it is perpendicular, the produced portion all lying below the lower margin of the eye, produced downward as a moderately sharp cone; face with sparse, long yellowish pile except on the tubercle, where it is black. Upper two-thirds of front and occiput shining black, the latter greyish pollinose, the former with a pale yellow orbital stripe extending half way to the vertex and connected broadly with the lower pale third, the pile of the

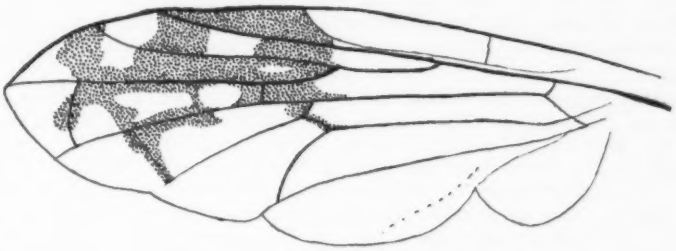

Fig. 1. Graptomyza mitis n. sp. Wing.
(Original wing 4 mm. long).

front brownish, of the occiput short, dense, whitish. Antennæ reddish; third joint large, twice as long as wide, slightly widened toward the apex, the lower edge of which is rounded, the upper corner subrectangular, tinged with brown above on the basal half; arista slender, slightly longer than the antenna, with only a few sparse, long hairs on either side, appearing almost bare.

Humeri white, mesonotum steel blue, its lateral and posterior margins translucent reddish yellow, the dark color projecting towards the angles of the scutellum, which is pale with a large transverse brownish or ferruginous depression on the apical half; pleura pale, pectus black and emitting black areas on to the lower portion of the pleura. Pile of thorax not abundant, whitish, short, the longer hairs and bristles yellowish. There is a prescutellar row of weakly differentiated bristles, the pile in this region being somewhat lengthened; two bristles on the postalar calli, two or three above the root of the wing, two or three weak ones above the lateral ends of the suture, the same number on the posterior edge of the mesopleura and about eight on the margin of the coarsely yellow pilose scutellum.

Legs reddish yellow, their pile yellowish; lower sub-apical half of the posterior femora with a broad brownish band, their tibiæ with a sub-basal and sub-apical band of the same color. Posterior femora moderately enlarged, their tibiæ stout, but all the legs rather robust.

Wings greyish hyaline, their base yellowish; marked with brown as follows: a broad fascia extending from the apex of the auxiliary vein to the fourth vein, covering the anterior crossvein and thence extending narrowly along the basal crossveins to the anal cell; a less broad fascia extending slightly apicad from the apical third of the stigma to half way across the apical cell and extending rather broadly along the third vein to obscurely join a squarish spot at the apex of the second vein; a spot in the discal cell beside the third vein just behind the inner end of the second fascia and an area at the tips of the wings, paler brownish, the markings perhaps of deeper color and slightly more extensive in fully matured specimens. The apical crossvein is strongly recurrent and ends almost behind the tip of the first vein, the posterior corner of apical cell rectangular; discal crossvein rectangular, with a slight curve apicad just before its end. Spurious vein very weak; marginal cell very widely open.

Abdomen reddish yellow, with indefinite brownish markings as follows: four obscure spots on the hind margin of the first segment; a broad, longitudinal median area on the second segment (partly interrupted by a broad geminate yellow vitta), the hind margin of the segment in the middle and a longitudinal triangle on either side; third segment similar; the fourth obscurely, indefinitely brownish on the basal half. The paler color may be described as rather diffusely brownish or dirty yellow in general, with a whitish yellow, medianly interrupted fascia on the base of the second segment which emits a lateral and subdorsal spot caudad almost to the hind margin, the third segment with similarly arranged, pale, smaller, disconnected spots, and most of the first segment is of this same color. The pile on the very pale areas is white and fine, elsewhere fuscous, appressed and coarser.

Described from two specimens from South Africa. Both specimens have pupal cases attached, but bear no data. Type in the Bishop Museum.

A NEW SPECIES OF CLASTOPTERA (HOMOPTERA, CERCOPIDÆ).

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During the last few years there has been added to the Snow collection a long series of a new species of *Clastoptera*. At first this species was determined as *Clastoptera proteus* var. *vittata*. Later, however, when material from the collections of Dr. Ball, L. A. Stearns, the National and American museums were studied it was evident that the species was entirely different from the specimens of the variety *vittata* found in these collections. A close study of these forms revealed certain well-marked differences, the outstanding ones, being the fact that *Clastoptera salicis* (sp. n.) is much larger than either *Clastoptera proteus* Fitch, or *Clastoptera proteus* var. *vittata* Ball and also has decidedly different color markings as is shown in the dorsal views of the three forms in the accompanying plate. The structure of the male genitalia also differs somewhat in the two species. See Figs. 1 and 2. The lateral hook of the style in *salicis* is longer in proportion to the width of the style than it is in *proteus*. See Figs. 3 and 4. At first this seems an unappreciable difference but from a study of other members of this genus it seems that the genital characters in this genus do not differ as much even among widely separated species as they do in other genera of Cercopidæ such as *Lepyronia*.

Clastoptera salicis has been taken only on two species of willow, *Salix amygdaloides*, Anders, the broad-leaved willow, and *Salix longifolia* Muhl., the narrow-leaved willow, which border rivers. Specimens are at hand from four counties in Kansas. In a series of seventy specimens only three males were taken.

The type specimens are to be found in the Snow collection, University of Kansas.

A yellow and black species, resembling *Clastoptera proteus* var. *vittata*, but considerably larger, exceeded only in length among the known North American species of Clastoptera by *Clastoptera osborni*.

Size: Length, ♀, 4.4 mm.–5.2 mm. ♂, 4 mm.; width, ♀, 2.4 mm.–2.8 mm. ♂, 2.4 mm.

Color: Dark brown or black, and conspicuously marked with yellow. Vertex with anterior black border reaching ocelli, the rest yellow. Pronotum black with black anterior margin followed by a yellow band which extends to the bases of the eyes and with a second yellow band on posterior half, which may be reduced to just a spot or be entirely lacking. Scutellum, usually entirely black or brownish-black, but frequently with apex light yellow or occasionally a light longitudinal band extending

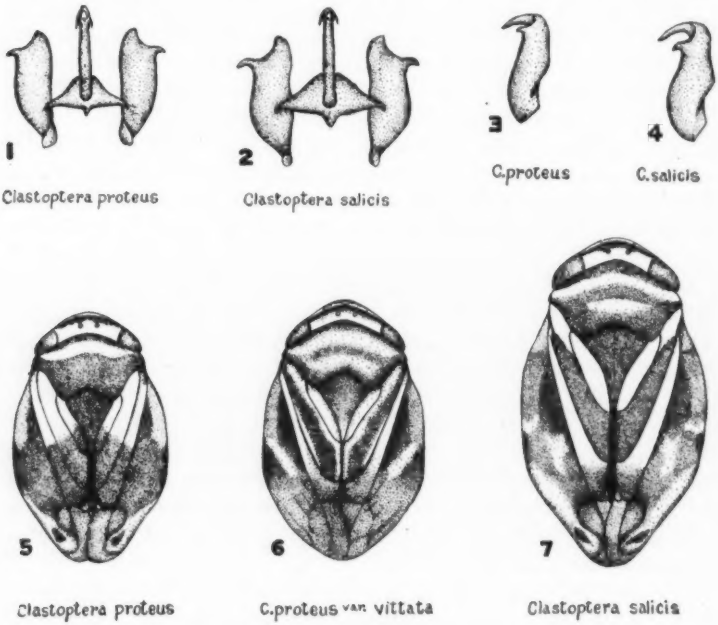

Fig. 1. Internal Male Genitalia of Clastoptera proteus.
Fig. 2. Internal Male Genitalia of Clastoptera salicis sp. n.
Fig. 3. Lateral View of Style of C. proteus.
Fig. 4. Lateral View of Style of C. salicis.
Fig. 5. Dorsal View of Male of C. proteus.
Fig. 6. Dorsal View of Female C. proteus var. vittata.
Fig. 7. Dorsal View of Female C. salicis.

along median line, which sometimes broadens just in front of middle into two light spots. Elytra blackish-brown and yellow, clavus appearing striped, due to two yellow bands which start together at base, the one extending one-half to almost two-thirds the length of the clavus, leaving a narrow black border along the elytral margin and the other extending along the claval suture almost to tip; corium dark brown, spotted with yellow as follows: a small longitudinal spot at base of

costal margin; a large rounded or rectangular one about midway on costal margin and just caudad of this but near the claval suture a longer, somewhat trapezoidal or triangular one, bulla surrounded by yellow with a large spot cephalad, tapering to a point anteriorly, usually a line near costal margin, extending from bulla to the large brown spot near middle of costa, the cell between bulla and this spot being hyaline and another small hyaline area, usually showing in the yellow spot, cephalad of bulla. Face, anterior third of half of clypeus and genæ shiny black, the rest of face yellow, beak dark at tip. Coxa, trochanter, and femur of first two pairs of legs yellow, washed in orange or light brown, tibiæ and tarsi black with sometimes a yellow band or mark at base of tibia. Hind legs entirely yellow, with the exception of the last two tarsal segments and spines on tibiæ and tarsi, which are black or dark brown. Mesosternum brown or black; metasternum yellow. Abdomen brown or black, sometimes posterior margins of segments lighter.

Structural details: Vertex slightly depressed transversely, anterior margin not distinctly carinated. Eyes level with vertex, each being slightly over one-fifth total width of head. Ocelli located slightly nearer anterior margin of vertex than pronotum and distance between the two ocelli less than distance between each ocellus and eye. Clypeus strongly inflated, indistinguishably fused with front, which is prolonged anteriorly beyond vertex, being somewhat longer in the female than in the male, but not as much as in *delicata* and *lineatocollis;* labrum half length of combined clypeus and front, labium reaching to trochanter of middle pair of legs. Pronotum finely wrinkled, cephalic margin produced, posterior margin deeply emarginate, about half the width of anterior margin, lateral margins slightly sinuate. Elytra approximately two and one-half times as long as wide, base of costal margin flaring, then parallel margined to apical third of wing, from whence it abruptly incurves to rounded apex. External genitalia, pygofer length equal to width, exceeded by ovipositor about one-half its length; male genital plates broad at base, inner margins rounding to blunt apex. Internal male genitalia with style broad and stout, basal apex extended into a flap, apical fourth at base, bearing laterally a recurved hook, from whence it tapers to a dorsad-curving sharply-pointed apex; connective roughly triangular, twice wider than long, oedagus a straight rod with a rounded apex.

CLIMATE AND COLORATION IN SOME WASPS.*

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The following discussion has developed as the result of studies on the solitary wasps of the subfamily Sphecinæ. The writer thinks it not unlikely that other groups of wasps would repay investigation along these lines, but he has not had an opportunity to study them in this way.

In the Sphecinæ the insects have commonly been placed in two genera: *Sphex* (*Ammophila* auct.) and *Psammophila*. In the first named genus there is a long, slender petiole consisting of two segments: in the other the petiole has but one segment. The insects of the group as a whole are black, but with more or less of a color which, for convenience, may be called red, though in fact it is more nearly ferrugineous. This color, if present at all (there are some wholly black species), is found on the second petiolar segment in *Sphex* and on the abdominal segment next behind: in *Psammophila* it is on the first segment behind the petiole, which would correspond to the second petiolar segment in the other genus.

Study of long series of examples of species in both of these genera shows much variation in the amount of red present in the same species from different localities, and has resulted, after years of study, in the formulation of the following propositions:

I. In the Sphecinæ the amount of red present is determined: (1) by sex; (2) by climate, particularly humidity.

II. (1) In the most humid climates there is the least red. (2) In the semi-arid regions the amount of red varies with the varying humidity of different seasons; hence material from these regions collected in different seasons, or even of different generations the same season, may vary considerably in the amount of red present. (3) This will hold for unusually dry seasons in regions which are generally humid, though perhaps less markedly than for the semi-arid regions.

III. The greatest amount of red found in specimens found from arid regions.

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*Contribution from the Entomological Laboratory of the Massachusetts Agricultural College.

IV. It is at least probable that size in the adult Sphecinæ is influenced by the amount of food available for the larva, and that occasional marked departures from average size may be accounted for in this way.

In support of these propositions a quantity of evidence has been accumulated in the Sphecinæ, which cannot be presented in detail within the limits of this paper. An outline of it is possible, however.

The common insect *Sphex procerus* (Dahlb.) may be used as an example. This species is widely distributed over the United States, Canada, Mexico and Guatemala at least. From New Hampshire to well down the Florida peninsula close to the shore, these insects show a minimum of red. A little distance back from the shore the red becomes more prominent, except perhaps in Florida with its general humid climate everywhere. The type of *procerus* came from Dom. Zimmerman who appears to have collected mainly in the Carolinas. The specimen which meets type requirements is in the Berlin Museum; is a male; and is quite dark as compared with specimens from points farther inland. *Sphex gryphus* (Smith), the same species, was described from specimens of both sexes taken at Charleston, S. C., East Florida, and California. Here the female is of the darker type, though not extreme in this regard, while the male (from California), as Smith states, has more red on the abdomen.

Sphex conditor (Smith), also this species, from St. Johns Bluff, Fla., is a very dark example, as is to be expected from the locality where it was captured.

Going westward from the Atlantic Coast we find that the specimens of this insect show what may be termed the normal amount of red, though an occasional specimen taken near a large body of water, such as one of the Great Lakes, or a large river like the St. Lawrence, manifests something of a reduction of color. On approaching the 100th meridian, however, in the more northerly States, much variation among the specimens is noticeable, and in a few cases it has been possible to obtain information regarding the nature of the particular season in which these insects were taken, at their places of capture. This shows that the specimens having the largest areas of red were taken during or following unusually dry and hot periods, while the darker ones were taken in cooler, wetter seasons.

Passing west into the arid regions, the red areas on the insects become larger, and this condition remains until the humid conditions of the West Coast are reached, where darker forms reappear, and in British Columbia and Washington, quite typical forms again are met with.

Passing west in the Southern States, this same relation may be observed. As far west as Eastern or Central Texas the color is only normal in its extent, but in Western Texas, New Mexico and Arizona, it covers a greater area.

In western Nebraska, arid conditions appear to begin to make their influence felt on this insect, and in Southern and Western Colorado the red area is considerably enlarged. This condition appears to reach its maximum in Utah and Nevada, whence come some of the specimens which show the largest amount of red, with the exception of some from California.

Going south on the Pacific Coast, perplexing forms not lending themselves as readily to analysis are met with. The writer is not familiar with local climatic conditions in that region, and has been dependent upon others for information. From this, it would seem that rather humid areas locally, in Central California, occur not far from arid ones, and it is possible that this may explain the presence of considerable color variation of these insects in localities not very far apart. In general, passing south, rather typical forms are found in Washington, Oregon, and Northern California, but as the arid regions are approached, more red appears, and toward Southern California the red begins to occupy a larger area on the abdomen than the black, which may be reduced to separated spots or a black terminal dorsal plate and a spot or two, producing *Sphex sæva* as described by Smith. Farther south this form becomes more abundant and it is not unlikely that it is present in Western Arizona and Lower California. It is noticeable that in the reduction of the black on the abdomen the red encroaches from the sides of the segments first, and that in form *sæva* the black spots are at or near the dorsal median line.

Sphex striolatus (Cam.) from Ventanas, Durango, Mexico, closely resembles *sæva*. The type is in poor condition but structurally it agrees with *procerus*. Coming from an arid region, 2,000 feet high, conditions there would be such as to lead one to expect specimens to have a large amount of red.

Other specimens of *procerus* from various parts of Mexico support the general propositions, individuals from close to the Gulf of Mexico being darker while those from higher and dry regions show more red, *striolatus* marking about the extreme in this regard.

Sphex ceres (Cam.) and *Sphex championi* (Cam.) from San Geronimo, Guatemala are described from a male and a female. The types, in the British Museum, are undoubtedly specimens of *procerus*, the male (*ceres*) being rather dark and the female (*championi*) a little darker than the typical form. Cameron is incorrect in placing *ceres* in the group having no red on the abdomen, for a faint red shade is present on the type.

These specimens in the British Museum have been placed (probably by Mr. R. E. Turner) in connection with the name *barbata* Smith. Unfortunately, the type of *barbata* appears to have been lost, and the description is not sufficient to accurately determine its identity. It is perhaps a dark *procerus*, though its size—"13–13½ lines"—is small for *procerus* and it may prove to be a different species.

In *Psammophila violaceipennis* Lep. and *Psammophila valida* Cress., the same feature of color area as related to humidity, holds. The distribution of *P. violaceipennis* and its changes in the red area in different localities might almost be described in the same words as those already used for *Sphex procerus*. Other species having a more restricted distribution, also support the propositions formulated, as far as the localities where they occur, permit.

Finally, a study of size distribution shows a few specimens of each species much smaller than the rest, and in this way *Sphex macrus* (Cress.) is found to be only a small male specimen of *S. procerus*, and darker than is perhaps usual.

Variation in color area, due to differences in sex and in humidity, have therefore, resulted in the production of seven and perhaps eight synonyms for the single species *Sphex procerus* (Dahlb.), and only a geographical study of the species with reference to climate has made recognition of this fact possible.

Knight (Ann. Ent. Soc. Am., XVII, 258–272, 1924) considers the relation of temperature and humidity to color forms in the Hemipteran *Perillus bioculatus* (Fab.) and comes to the conclusion that "variations in the black color pattern of Hemip-

tera, and doubtless other insects, are produced by changes in physiological activity of the insect; and this rate of physiological activity, or metabolism, is governed chiefly by the temperature to which the individual insect is subjected." How far the active life of an Hemipteran nymph can be compared with that of a parasitic larva living in a hole in the ground, on food provided for it, is difficult to determine. As there is no evidence of any change in area of color pattern during adult life, in the Sphecinæ, however, the factors causing this must presumably act on the larva, or pupa, or both, and the condition of the soil at the nests, as regards both heat and dampness, is of importance. As black covers larger areas in these insects in the hot but humid areas of the South while an increase of the red is met with even in parts of Canada, where the maximum temperatures are presumably lower than in Eastern Texas for example, but where there is much dryness, it would seem that Knight's view that humidity in the case of *Perillus* is of less importance than temperature, may not entirely hold for all insects.

SYNONYMIC NOTE.

Notonecta bergrothi Esaki.

In 1925 there appeared two descriptions of a new Notonecta species from China. I described some specimens from Shanghai, China, in the Annals of the Entomological Society of America, Vol. XVIII, p. 417, under the name *N. suensoni*. Before the appearance of this description in print, but too late to withdraw it, I received a reprint from my friend, Tieso Esaki, describing *Notonecta bergrothi* from material in the Helsingfors Museum. These insects were from Chanka, Amur River region and the description was in Notulæ Entomologicæ V, p. 14. I surmised from the description of *Notonecta bergrothi* Esaki that my *N. suensoni* was the same thing. In the Entomologische Mitteilungen Band XIV, Nr. 5–6, p. 313, 10 Oct. 1925, Mr. Esaki gives a figure of his *N. bergrothi*. Through the kindness of Dr. Lindberg I have received a paratype of *N. bergrothi*. The specimen is a female, but I feel quite sure my species is a synonym.

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LIFE HISTORIES OF SOME KANSAS "BACKSWIMMERS."

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The "backswimmers" or Notonectidæ consists of ten genera and approximately one hundred fifty described species. The life histories of scarcely half a dozen are known. That of only one American species has been in any way completely followed.

It is therefore a pleasure to report life history data for the following five species common in the state of Kansas: *Buenoa margaritaeca* Bueno, *Buenoa scimitra* Bare, *Buenoa elegans* (Fieber), *Plea striola* Fieber, and *Notonecta undulata* Say. Two or three other Notonectids are reported from the state, but they are rare or of doubtful determination. All of the five species just listed were reared from egg to adult in a University of Kansas laboratory during the season of 1925. The rearings of the three species of *Buenoa* are the first for that genus. That of *Plea striola* is new, and additional notes are given for *Notonecta undulata* first reared in 1917.

Since about 1895 various attempts have been made to rear the Notonectids, but usually they have been only partially successful. The writer tried to rear *Buenoa* during the seasons of 1923 and 1924 but failed. The difficulties have been in establishing conditions in the aquarium duplicating those of the ponds or natural habitat of these insects. At least three important factors have been at fault; the oxygen content of the water; the condition of the surface film; and the food supply.

Interest was first aroused in this group by a study of the oxyhæmoglobin cells present in the abdomen of *Buenoa*. In attempting to rear the early stages and at the same time note the development of these very interesting cells, it was found that few nymphs ever reached the second instar in the stender dishes used. It even took the eggs longer to hatch there than out in the ponds. Frequently changing the water in the stender dishes did little good. When it was not so changed, a scum formed over the surface after one or two days. Then the bugs died more quickly. The daily removal of this scum helped the

situation but did not remedy it. It occurred that the trouble probably was due to oxygen deficiency and the greater difficulty in breaking the surface film when covered with scum. Air forced through the water with a large pipette almost immediately revived the dying bugs, but the relief was only temporary. Then a device first described in 1910 for continuously aerating an aquarium was used. It was a success, and must be credited for the life histories of the genus *Buenoa*.

Another difficulty was the food supply. Ostracods and such minute organisms as the *Buenoæ* and *Pleæ* usually fed upon were inconvenient to collect. Other workers had reported mosquito wrigglers as good food for Notonectids. So during most of the season mosquito eggs were collected each morning from one or two tubs of rainwater and kept in a smaller vessel until the next day when they hatched and served quite well as food for all sizes and species. A barrel of rainwater near the insectary supplied larger mosquito larvæ for the more mature nymphs and adults of *Notonecta* and *Buenoa*. But even tiny *Plea* did not hesitate at times to attack almost full grown mosquito wrigglers.

Other factors than those just mentioned should be considered. The laboratory was in a basement which affected the temperatures and lighting, and it was artificially heated during the latter part of the season. All aquarium jars save a few kept as controls were constantly aerated, and each was supplied with sprigs of Ceratophyllum. Careful regulation of the air was necessary to prevent too vigorous bubbling. With strict attention to details *Notonecta* and *Plea* were easily reared, but several attempts were necessary to get the full story for the *Buenoæ*. The mortality due to moulting was considerable, as must also be true in the ponds; and nematodes seemed to cause the death of many. All aquaria were filled with pond water.

Buenoa margaritica Bueno.

In 1917 Dr. Hungerford discussed the biology and gave descriptions of the stages of *Buenoa margaritacea* Bueno. During the past season we reared three specimens from the egg stage to adult. The rearings included two generations besides a number of partial ones. The total period of development for the egg and five instars required from fifty-two to seventy-one days. The first specimen reared was a male from an egg laid

June 25th. It moulted into adult August 19th. On July 9th a male and female taken as fifth instars in the pond moulted into adults in the laboratory. From these on July 25th, just sixteen days later, a number of eggs were seen to be laid in a stem of the Ceratophyllum. This gave the preoviposition period for this insect and some information as to the possible number of generations per season. From these eggs one adult female died in the last moult September 29th. So it is certain there are two generations per season and quite likely a partial third. In the ponds the broods most numerous around June 25th and September 1st also indicate two generations.

The male which moulted into adult August 19th first began stridulating twelve days later on August 31st, and was frequently heard for several days thereafter. The stridulation, a kind of rasping sound, was loud enough to be heard twelve or fifteen feet away. It was like the words, "thweek, thweek, thweek," repeated in quick succession half a dozen times, interrupted by quiet for a minute or two, and then repeated again.

The females frequently were seen ovipositing; first, during the spring of 1924 when the earliest eggs were found April 24th. Head downward with hind legs in normal swimming position, they grasped the stem of Ceratophyllum with extended forelegs and touched the location chosen for oviposition with the tip of the seventh sternite. Then with a backward scooping motion of the ovipositors they hollowed out a place for the egg. It required about fifty seconds to scoop out the tissues of the plant and ten seconds more to place the egg. Six or eight eggs were sometimes laid within a few hours. Ovipositing was somewhat periodical. More eggs were laid every fourth or fifth day, and so continued for weeks frequently interrupted with copulation.

In copulation usually lasting half an hour, the male was somewhat to the dextral side. The plane of motion formed by the swimming hind legs of the male was at an angle of about twenty degrees to that of his mate. During this time the female did the swimming.

Both nymphs and adults, ordinarily feeders on the smaller crustacea, frequently were seen to feed greedily upon the larvæ and pupæ of mosquitoes.

They were positively phototropic, and the adults often have been taken at lights.

The adults overwintered in the ponds. It may be of interest to record that on January 22nd, 1924, a number of *margaritacea* together with one specimen of *N. undulata* and a few small Corixids were taken swimming in a pond beneath ice one foot in thickness.

Buenoa scimitra Bare.

Buenoa scimitra, first described in October, 1925, has heretofore been confused with *Buenoa margaritacea* Bueno because of its similar appearance. Its life history gave it further positive identification, for the males reared possessed the same sword shaped stridular area as that of their parents.

Besides a number of partial life histories, six specimens, five females and one male, were reared from egg to adult. The total period of development including five instars was from fifty-eight to seventy-seven days. While oviposition must occur earlier, the eggs first were laid in the laboratory in stems of Ceratophyllum on July 27th, and the last adult emerged November 6th. The manner and place of oviposition, as would be expected from the ovipositor, was the same as for *B. margaritacea*. The females often were seen ovipositing, usually in early morning or midafternoon of bright sunny days. Oviposition continued in the same manner as it did with *margaritacea* until cold weather. The broods in the ponds mostly occupied by *scimitra* were most plentiful about July 10th and again about September 10th. This indicates two generations per season also for this species.

Adults frequently flew to lights in the laboratory.

Nymphs and adults did well feeding on mosquito larvæ and pupæ, but also fed on Entomostraca.

They have been taken during every month of the winter season. They hibernate as adults in the deeper more permanent ponds, but not often in company with *margaritacea*.

Buenoa elegans (Fieber).

The species known as *Buenoa elegans* (Fieber) has been reported by Bueno and Hungerford as being found in clear spaces in shallow protected waters along shore while the larger

margaritacea occupied the more open and deeper waters farther out. No recorded attempt has heretofore been made to secure its life history.

After careful search the first specimens were taken in a muskrat runway on June 23rd. At the same time and place a number of eggs were found in stems of grasses and sedges. Only two pairs of adults were secured and brought to the laboratory. Each pair was kept in an aquarium until in October when they seemed to die of old age. They were the prettiest and most graceful of the three species of *Buenoa*.

Besides many partial rearings, three specimens fed mostly on mosquito larvæ were reared from the egg stage through five instars into adults. The total period of development was from forty-two to fifty-two days.

Throughout the summer the females kept laying eggs and many times were seen in copula after the same manner as *margaritacea*. Oviposition was like that of *margaritacea* and *scimitra*. When the females were ovipositing the males would swim about and around them as though somewhat excited. Often the males were seen courting the females and heard stridulating very much like *margaritacea*. But the stridulation was not loud. It could not be heard more than six or eight feet away, and it was more like the words, "thick, thick, thick," spoken in quick succession.

The feeding habits were the same as for the other *Buenoæ*, but they were more cannibalistic.

One of the reared specimens was yet alive in the laboratory on December 28th.

Plea striola Fieber.

In 1919, Dr. Hungerford noted the oviposition and egg stage of *Plea striola* Fieber. In 1924 Bueno confirmed those notes.

At Easter time, April 14, 1925, a number of *Plea striola* were taken among sedges in shallow water near Coldwater, Kansas. One pair was seen mating in the ponds there. The manner of mating was about the same as described and figured by Wefelscheid of Germany for *Plea minutissima* Leach. This pair was brought to the laboratory but upon arrival was dead. Another pair, taken in some Myriophyllum from the same pond, was placed in an aquarium; but little attention was given to it until the male died about June 23rd.

On July 15th all developmental stages of eggs laid after June 23rd, and first instar nymphs were present. These were isolated and some reared to adults. The eggs were placed in the leaves of the Ceratophyllum but never in the stems. The *Buenoæ* always placed their eggs in the stems. In one case *scimitra* placed its eggs in the leaves of Ceratophyllum when no stems were provided. The single adult female *Plea* kept laying eggs every day or two until August 22nd when she disappeared either by flying away or by crawling out over the sides of the aquarium. During the time of observation she laid thirty-two eggs in thirty-six days or a total of forty-nine eggs altogether.

From these, eleven specimens were reared to adults. Two of them were reared in nonaerated water by simply changing the water frequently and keeping it clear of scum as has been done in rearing *N. undulata*. The other nine were reared in aerated water. Rearings were more successful in aerated water. The total period of development from egg to adult through five instars was slightly over two months. None of the eleven adults reared laid any eggs before winter. This seems to show there is not more than one generation per season.

All instars and adults were positively phototropic and thigmotactic. None were ever seen in flight. Both nymphs and adults clung to the sides of the glass aquarium nearly as well as a fly to a wall.

All fed either upon Ostracods or mosquito larvæ. The nymphs often were seen clinging tenaceously to mosquito wrigglers much larger than themselves. At the same time they kept piercing the wriggler's body in various parts until it ceased to struggle. Then the *Plea* would suck out the body juices for perhaps fifteen minutes longer. In one case a second instar form was seen feeding upon a tiny mayfly naiad.

Since adults were taken in the ponds in April, and since ten specimens were yet living in the laboratory in midwinter and requiring but little food, they must winter as adults in the ponds and beneath the ice.

Notonecta undulata Say.

In 1917 in Entomological News, Dr. Hungerford gave a summary of the biology and life history of *Notonecta undulata* Say. The laboratory rearings and field observations of the past

season have verified that summary. The following notes are additional.

On July 3rd a specimen of *Ranatra* and one of *N. undulata* were placed in an aquarium. The next day the *Ranatra* was kicking about with a number of *Notonecta* eggs attached to its body and legs and one on the side and almost at the tip of its beak! Ten days later the *Ranatra* was dead and four of the eggs were hatched. The young nymphs were isolated, fed almost entirely upon mosquito larvæ, and reared to maturity in from forty to fifty-two days. Other fourth and fifth instars were brought from the ponds and reared to maturity in the laboratory.

One fourth instar moulted into the fifth instar on July 17, and into an adult on July 30th. On August 13th, thirteen days after becoming adult, it laid two eggs; and on the days following laid many more. None of the eggs ever showed sign of development and no doubt were infertile since mating had been prevented. But this record showed the preoviposition period to be about thirteen days, and gave more evidence as to the possible number of generations in a season.

It has been noted there are two main broods in a season. Several times nymphs in the fourth and fifth instars have been taken in November, and it is quite possible that in Kansas and farther south there are as many as three generations in a season.

The aerator was not used in rearing this species, but it might have given quicker results. The water in the aquarium was simply changed each day or cleared of the scum on its surface.

The tabulation of data herewith, secured for these life histories, includes other facts not mentioned in the preceding pages. The bibliography lists the most important references used.

Notonectidæ of Kansas	*Buenoa margaritacea* Bueno, 1908	*Buenoa scimitra* Bare, 1925	*Buenoa elegans* (Fieber), 1851	*Plea striola* Fieber, 1851	*Notonecta undulata* Say, 1832	*Notonecta irrorata* Uhler, 1878 (Two specimens have been taken)	*Notonecta variabilis* Fieber, 1851 (Determinations doubtful, or	*Notonecta raleighii* Bueno, 1907) (?)
	Days	Days	Days	Days	Days			
Egg	10–13	6–	10–12	20–21	9–14			
1st Instar	4–7	11	5–7	10–15	4			
2nd Instar	5–8	10	5	10	4			
3rd Instar	7–12	7–9	5–8	6	4			
4th Instar	12–	10–13	5–8	8–11	8–10			
5th Instar	14–17	14–28	12	10	11–15			
Total Development	52–71	58–77	42–52	64–73	40–52			
Preoviposition Period	16	?	?	over winter ?	13			
Total generation	68	?	?	?	53			
Longevity (So far as determined)	♂ = 116 ♀ = 113 & over winter	♂ = 100 ♀ = 128 & over winter	♂ = 109 ♀ = 140 & over winter	188 & over winter				
Number specimens reared	3	6	3	11	4			
Number generations reared	2+	1+	1+	1+	1+			
Generations	2+?	?	?	1?	2+?			
Number eggs from individual secured	163	?	189	49	21			
Notes			1 reared, ♀ adult yet living in laboratory Dec. 28, 1925	10 reared adults yet in laboratory Dec. 28, 1925	1 reared, ♀ adult yet in laboratory Dec. 28, 1925			

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ENTOMOLOGICAL SOCIETY OF AMERICA.

PROCEEDINGS OF THE TWENTIETH ANNUAL MEETING
Kansas City, Missouri, December 29 and 30, 1925.

The Twentieth Annual Meeting of the Entomological Society of America, held in Kansas City, December 29 and 30, 1925, was one of the most successful meetings of recent years. Although the attendance from the Atlantic States was not large, this was offset by increased attendance from the middle and far West and from the South. The attendance at the several sessions ranged from about 40 at the business session on Wednesday morning to over 450 at the annual public address on Wednesday evening. At the latter session, Dr. Vernon Kellogg, Secretary of the National Research Council gave an inspiring address on the subject "Cooperation or Isolation in Science?" Following this, Dr. L. O. Howard, Chief of the Bureau of Entomology, in his inimitable style, entertained the audience with intimate, chatty accounts, illustrated with lantern slides, of the many European entomologists whom he met last summer at the entomological congress in Zurich, which he attended as a delegate of the Society.

The two sessions for the presentation of papers on Tuesday had an average attendance of over 100 and dealt with a variety of research on insects, as indicated by the detailed program below.

On Wednesday afternoon the Society met in joint session with the American Association of Economic Entomologists for a symposium on parasitism. At this session, which was attended by about 400, the results of the gigantic experiments being carried on by American entomologists to control various imported insects by the introduction of their natural enemies from abroad, were presented by the specialists in this field. Summary papers dealing with the theory of control by parasitism, the effects of weather upon the abundance of parasites and the effects of parasitism on the host and on the parasite were also presented.

A number of interesting exhibits were presented by members but lost much of their value by the inability of the Society to secure exhibition facilities adjoining the meeting place. The presentation of papers was also considerably hampered by the small screens provided for projection.

Opening Session, Tuesday Morning, December 29.

The Society was called to order at 10:00 A. M. by Professor George A. Dean, in Room B, of the Kansas City School of Law. The attendance ranged from 85 to 100. The following papers were presented:

1. Mating, the Regeneration of Appendages, in Tarantulas. W. J. BERG, Arkansas Agricultural Experiment Station.
2. The Secondary Sexual Characters of the Coleoptera. EDWIN C. VAN DYKE, University of California.
3. The Genus *Chlorotettix*, a Study of the Internal Male Genitalia. D. M. DELONG and OSCAR L. CARTWRIGHT, Ohio State University.
4. Notes on the Comparative Physiology of Insects and Mammals: Effect of the Vegetable Cathartics, Aloin and Podophyllin. R. D. GLASGOW, University of Illinois.
5. Two Factors of Heat Energy Involved in Insect Cold Hardiness. NELLIE M. PAYNE, University of Minnesota.
6. Climate and Coloration of Some Wasps. H. T. FERNALD, Massachusetts Agricultural College. (Read by the Secretary).
7. The Bionomics of a Parasite of Adult Lady-Beetles. W. V. BALDUF, University of Illinois.
8. Preliminary Studies of the Intracellular Symbionts of *Saissatia oleæ* Bernard. A. A. GRANOVSKY, University of Wisconsin.
9. New Intermediate Insect Host Records for the Giant Thornheaded Worm of Swine. R. D. GLASGOW, University of Illinois.
10. A Simple Device for Use in Drawing Small Symmetrical Objects. (By Title). RALPH H. SMITH, San Francisco, California.
11. The Place of Drawings in Teaching General Entomology. E. W. STAFFORD, A. & M. College, Mississippi.
12. The Coleoptera of the Sand Hill Region near Medora, Kansas. W. KNAUS, McPherson, Kansas.
13. Certain Genitalic Characters in *Laspeyresia molesta* Busck, and *Laspeyresia prunivora* Walsh. (By Title). S. W. FROST, Arendtsville, Pennsylvania.

The following Committees were appointed by the President:

To serve as substitutes for absent members of the Executive Committee—E. D. BALL, J. M. SWAINE, W. A. RILEY, J. J. DAVIS, WM. S. MARSHALL.
Nominating Committee—ARTHUR GIBSON, H. B. HUNGERFORD, R. W. HARNED.
Resolutions Committee—J. J. DAVIS, J. A. HYSLOP, C. J. DRAKE.
Auditing Committee—S. B. FRACKER, W. J. BAERG, E. C. VAN DYKE.
Special Committee to prepare suitable resolutions on the death of H. A. Gossard and W. D. Hunter—L. O. HOWARD, J. S. HOUSER, HERBERT OSBORN.

Second Session, Tuesday Afternoon, December 29.

The Society was called to order at 1:50 P. M. in Room B of the Kansas City School of Law by President Dean. The following papers were presented. Attendance 100.

14. Life History of Some Kansas "Backswimmers." CLARENCE O. BARE, University of Kansas.
15. On the Biology of Three Species of *Pyrausta* in Northern Ohio. (By Title). F. W. POOS, European Corn Borer Laboratory, Sandusky, Ohio.
16. A Chapter in the Life History of *Mordwilkoija vagabundus*. (By Title). O. W. OESTLUND and F. C. HOTTES, University of Minnesota.
17. The Life History and Habits of *Eremochrysa punctinervis* McLach (Neuroptera). ROGER C. SMITH, Kansas State Agricultural College.
18. Notes on the Biologies of the Meal Worms, *Tenebrio molitor* L. and *T. obscurus* Fab. (By Title). RICHARD T. COTTON, U. S. Bureau of Entomology.

19. Description and Identification of Some Chironomid Egg-masses. HAZEL E. BRANCH, Fairmount College.
20. The Bronzed Cutworm, *Nephelodes minians*, a Pasture Pest. J. S. HOUSER, Ohio Agricultural Experiment Station.
21. The Problems in Distribution of Hawaiian Odonata. (By Title). CLARENCE H. KENNEDY, Ohio State University.
22. Faunistic and Ecologic Notes on Cuban Homoptera. HERBERT OSBORN, Ohio State University.
23. Contribution to the Knowledge of the Interrelations of the Bumblebees of Illinois with their Animate Environment. THEODORE H. FRISON, Illinois State Natural History Survey.
24. The Distribution of African Termites. (By Title). ALFRED EMERSON, University of Pittsburgh.
25. Nomenclatural Needs and Possibilities in Generic Names. E. P. FELT, New York State Entomologist. Read by the Secretary.

Third Session, Wednesday Morning, December 30.

The Society met in business session at 10:30 A. M. in the Kansas City School of Law, Room B, President George A. Dean presiding. Attendance 40 members. The first order of business was the

REPORT OF THE SECRETARY.

On June 1, 1925, the following seven persons, having been duly nominated and recommended, were elected members of the Society by mail ballot of the executive committee:

BARNARD S. BRONSON, State College for Teachers, Albany, N. Y.
GEORGE M. DECHERD, JR., 2809 Rio Grande St., Austin, Texas.
ELLIOT ROWLAND DOWNING, 6031 Kimbark Ave., Chicago, Ill.
KARL W. JOHNSON, Entomology Department, Ames, Iowa.
ERNEST ALEXANDER MCGREGOR, Box 576, Lindsay, California.
KENNETH EDWARD STEWART, 148 Brighton Ave., Ottawa, Ontario, Canada.
MARTIN TRANTHAM YOUNG, Box 165, Tallulah, La.

By direction of the Executive Committee, Dr. Vernon Kellogg was invited to give the annual public address of the society at the Kansas City meeting. By mutual consent it was decided to hold a symposium on the subject, *Parasitism*, jointly with the American Association of Economic Entomologists; and the Secretary took the responsibility of making the arrangements for it. Prof. J. W. McCulloch kindly consented to act as local representative for the Kansas City meeting.

The Executive Committee met at 5:15 P. M., December 29, 1926, in Room 355, Hotel Baltimore, with the following members present: Prof. Dean, Dr. Ball, Dr. Howard, Prof. Davis, Prof. Osborn, Dr. Marshall, Dr. Van Dyke, Dr. Swaine, Dr. Riley, Prof. Caesar, and Prof. Metcalf.

The following new members were elected:

CYRIL E. ABBOTT.....24 South Liberty St., Elgin, Ill.
LLOYD ACKERMAN.....1886 Mannering Road, Cleveland, Ohio
HARRY KUTEMAN ADAMS.....Bussey Institution, Boston, Mass.
HARRY W. ALLEN.....Botany-Zoology Bldg., Columbus, Ohio
ARTHUR W. ANDREWS.....133 Tyler Avenue, Detroit, Mich.
CHARLES K. ARTER.....9th Floor, Guardian Bldg., Cleveland, Ohio
NORMAN JEFCOATE ATKINSON.....University of Saskatoon, Saskatchewan, Canada
KENNETH FRANCES AUDEN.....316 Natural History Bldg., Urbana, Ill.
PAUL PETER BABIY.....Dept. of Ent., Cornell, Ithaca, N. Y.
CHARLES A. BALLOU, JR.....86 Marlborough Road, Brooklyn, N. Y.
ERNEST L. BELL.....438 Amity St., Flushing, N. Y.
FERNANDO BELON.....Apartado 133, Arequipa, Peru, South America
JOHN HENRY BIGGER.....724 W. State St., Jacksonville, Ill.

THEODORE L. BISSELL.....Box 761, Thomasville, Georgia
W. S. BLATCHLEY.....1558 Park Ave., Indianapolis, Ind.
(Dunedin, Fla., from November to May)
PERCY G. BOLSTER.....217 Norfolk St., Dorchester Center, Boston, Mass.
O. E. BOOTH.....907 Clinton Ave., Des Moines, Iowa
ROBERT BOGUE.....2543 Capital Ave., Omaha, Neb.
CARL T. BRANDHORST.....Bremen, Kansas
DONALD J. CAFFREY.....10 Court St., Arlington, Mass.
C. R. CLEVELAND.....Purdue University, Lafayette, Ind.
LAURENCE VAIL COLEMAN.....1446 K St., N. W., Washington, D. C.
YUANTING, T. CHU.....Dept. Ent., Cornell University, Ithaca, N. Y.
JOHN FRANK DIRSCHMIDT.....8 East Huron St., Chicago, Ill.
PHILIP JACKSON DARLINGTON.....84 Corey Road, Brookline, Mass.
H. L. DOZIER.....Delaware Experiment Station, Newark, Del.
HOWARD O. DEAY.....1005 Kentucky St., Lawrence, Kan.
DAVID DUNAVAN.....Station A, Box 5, Ames, Iowa
THEODORE H. EATON, JR.....105 Brandon Place, Ithaca, N. Y.
FRANK LESTER ELSE.....4860 N. 15th St., Philadelphia, Pa.
HOWARD E. ENDERS.....249 Littleton St., West Lafayette, Ind.
LESTER LAMAR ENGLISH.....State Entomologist's Bldg., Urbana, Ill.
ROBERT M. FOUTE.....730 Quebec St., N. W., Washington, D. C.
ULYSSES S. GRANT IV.....1137 Oxford Road, Burlington, Cal.
VERNON R. HABER.....227 W. Beaver Ave., State College, Penn.
DAVID HALL.....1845 Indianola Ave., Columbus, Ohio
WM. A. HAREN.....4575 Forest Park Blvd., St. Louis, Mo.
WILLIAM BRODBECK HERMS.....1701 Marin Ave., Berkeley, Cal.
MORTIMER L. J. HIGGINS.....36 Inlay St., Hartford, Conn.
WILBUR L. HUTCHINSON.....Luzerne County, Canynghaff, Pa.
HENRY CLAY IRISH.....911 Locust St., St. Louis, Mo.
FRANK JOHNSON.....Room 1775, 50 Church St., New York, N. Y.
DETTMAR WENTWORTH JONES.....10 Court St., Arlington, Mass.
European Corn Borer Laboratory
W. RUSSELL JONES.....1900 E. Lloyd St., Pensacola, Fla.
CHARLES ATWOOD KOFORD.....University of California, Berkeley, Calif.
GEORGE S. LANGFORD.....Colorado Agricultural College, Fort Collins, Colo.
Department of Entomology
ANDREW OLOF LARSON.....Box 297, Alhambra, Calif.
FRANK A. LEACH.....Diable Country Club, Diable, Calif.
NORMAN WALLACE LEOMOND.....R. F. D. 1, Thomaston, Me.
ALFRED J. LISIESKI.....775 Forest Ave., New York, N. Y.
GEORGE M. LIST.....Colorado Agricultural College, Fort Collins, Colo.
WILLIAM W. LONG.....84 Pennsylvania
CHARLES H. MARTIN.....1539 Vermont St., Lawrence, Kan.
EDWIN P. MEINARS.....6600 Delmar Blvd., St. Louis, Mo.
WARREN C. MILLER.....High School, Bedford, Ohio
WIER ROBSON MILLS.....Pierson, Iowa
VERN G. MILUM.....110 Vivarium Bldg., Champaign, Ill.
LYMAN J. MUCHMORE.....928 W. 35th Place, Los Angeles, Calif.
ARTHUR E. MUELLER.....12 Armin Ave., Webster Groves, Mo.
FRANKLIN C. NELSON.....Rutger's College, New Brunswick, N. J.
REGINALD HOWARTH OZBURN.....Ontario Agricultural College, Guelph, Ontario, Can.
H. L. PARKER.....Le Mont Fenauillet, Hyeres, Var, France
LAWRENCE HENRY PATCH.....Box 283, Sandusky, Ohio
CLARENCE R. PHIPPS.....Maine Agric. Exp. Station, Orono, Me.
JOSEPH B. POLIVKA.....Experiment Station, Oak Harbor, Ohio
FRED ELMER POMEROY.....Bates College, Lewiston, Maine
EUGENE FRANCIS POWELL.....2133 St. Marys Ave., Lincoln, Neb.
EZEKIEL RIVNEY.....Massachusetts Agricultural College, Amherst, Mass.
COLONEL WIRT ROBINSON.....West Point, N. Y.
WM. PRESCOTT ROGERS.....353 Lincoln Ave., Fall River, Mass.
O. W. ROSEWALL.....Louisiana State University, Baton Rouge, La.

EDWARD WALDO EMERSON SCHEAR.....107 W. Park St., Westerville, Ohio
ROBERT SCHMALTZ.....1166 Glenmore Ave., Brooklyn, N. Y.
EUGENE E. W. SCHWARZ.....42 W. 69th St., New York, N. Y.
HERMAN A. SCULLEN.....2003 B. St., Corvallis, Ore.
MRS. CARRIE LAURA SIMONS.....4021 Alameda Drive, San Diego, Calif.
R. B. SMITH.....Butterfly Box, 70 Franklin St., Boston, Mass.
MISS NINA G. SPAULDING.....64 Centennial Ave., Glouchester, Mass.
LYLE STEPHENSON.....25 W. 52nd St., Kansas City, Mo.
EBEN H. P. SQUIRE.....2 Grand St., White Plains, N. Y.
JOSEPH MANSON VALENTINE....Yale Univ., Osborn Zool. Lab., New Haven, Conn.
GEORGE STILL.....404 W. Nevada St., Urbana, Ill.
H. P. STROHECKER.....123 Culver St., Macon, Ga.
FRED H. WALKER.....P. O. Box 456, Salem, Mass.
L. B. WALTON.....Kenyon College, Gambier, Ohio
SHEPPARD ARTHUR WATSON.....222 Fife Ave., Wilmington, Ohio
ANDREW GRAY WEEKS.....15 State St., Boston, Mass.
ELLSWORTH HAINES WHEELER, Massachusetts Agric. College, Amherst, Mass.
DON B. WHELAN.....University of Nebraska, Lincoln, Neb.
FRANCIS H. WILSON.....University of Richmond, Richmond, Va.
JOHN E. WILLIAMS.....309 Wilder Bldg., Rochester, N. Y.
FO CHING WOO.....Box 23, University Station, Urbana, Ill.
LAWRENCE C. WOODRUFF.....Box 1077, San Antonio, Texas

The following members have died during the year:

H. A. GOSSARD	LEWIS B. WOODRUFF
W. D. HUNTER	PHILIP SPANG
P. R. MYERS	W. B. TURNER

The following persons resigned during the year, and their memberships terminate December 21, 1925:

L. L. BUCHANAN	JAMES TROOP
H. W. BROLEMAN	MORRIS N. WATT
F. S. CARR	MORRIS A. STEWART
WALLACE PARK	F. L. WASHBURN

Two members whose dues are in arrears for more than two years and who have been duly notified, were dropped from membership.

Total membership December 23, 1924 (See Annals xviii, p. 133)		689
Members lost by death	6	
Members lost by resignation	9	
Members dropped	2	
Loss in membership during 1925		— 17
Balance		672
New Members elected during 1925		100
Total present membership		772

On December 28, the membership was in the following condition in respect to the payment of dues. The comparison with the preceding years is shown to illustrate the steady growth of the society.

	1925	*1924*	*1923*	*1922*	*1921*
Members and Fellows paid three years in advance	0	0	0	9	1
Members and Fellows paid two years in advance..	2	1	0	2	3
Members and Fellows paid one year in advance...	263	244	194	179	222
Members and Fellows paid for year just closed....	319	327	332	327	235
Members and Fellows one year in arrears.....	51	59	47	28	52
Members and Fellows two years in arrears.....	32	4	15	22	18
Members and Fellows three years in arrears.....	8	3	0	1	11
Life Members.....	18	15	15	15	13
Honorary Fellows.....	6	5	5	5	4
New members not yet paid.....	73	31	64	74	47
Totals.....	772	689	672	653	606

The following were elected members of the Thomas Say Foundation Committee: To succeed J. Chester Bradley, J. Chester Bradley; to succeed Arthur Gibson, Arthur Gibson. These terms to expire December 31, 1927.

The following were elected members of the Editorial Board to succeed R. W. Harned, R. A. Cooley, and G. C. Crampton: J. R. Watson, H. B. Hungerford, and Otto H. Swezey.

By action of the Executive Committee, the incoming Treasurer is instructed to look into the matter of investing the permanent funds of the Society in some form of securities that will yield a better rate of interest than Liberty Bonds, with the request that he consult with the executive committee before making the investment. The Managing Editor was authorized to consider the purchase of an addressograph outfit or addressograph plates for the mailing list of the Annals, with the idea that it should be used also for the Secretary's office.

The Managing Editor was authorized to make arrangements for exchanges where it can be done at membership rate or above. The Executive Committee expressed itself in favor of holding the 1928 meeting of the International Entomological Congress in America.

Respectfully submitted,

C. L. METCALF,
Secretary.

On motion, the Secretary's Report was accepted. The next item of business was the

REPORT OF THE TREASURER.

CURRENT FUNDS.

RECEIPTS.

Balance, Dec. 29, 1924 (See Annals, XVIII, p. 124)	$ 981.86
From Annual Dues of Members	1,888.50
From Managing Editor of the Annals	666.97
From Interest on Bonds	32.46
From Life Membership Fees (Geo. J. Spencer, Edith M. Patch, Wm. A. Hoffman)	150.00
Gained by exchange	.17
Check refused by bank	3.00
Total	$3,722.96

EXPENDITURES.

Annals for December, 1924 (XVII, 4) including reprints	$ 467.75
Annals for March, 1925 (XVIII, 1) including reprints	630.00
Postage and wrappers for Annals	29.87
Printing and Stationery	63.75
Postage	48.59
Rental of Typewriter	10.00
Office Supplies	3.40
Clerical and Stenographic Help	146.15
Telegrams	3.22
Check Refused by Bank	3.00
Lost by Exchange	.06
Gift to Zoological Record including Fee	50.62
Liberty Bonds purchased for Permanent Fund	350.00
Premiums and Accrued Interest on same	4.00
Total	$1,810.41
Balance, Cash on Hand, First National Bank, Champaign, Ill., Dec. 26, 1925	1,912.55
	$3,722.96

LIABILITIES.

The Society owes the publishers of the Annals for the June, September and December issues of the current year. We owe also for printing the programs for the Kansas City Meeting, $29.50; for printing 1000 envelopes, $8.75; and for a rubber stamp, $0.45.

CONDITION OF PERMANENT FUND.

On hand, latest report (Annals, XVIII, p. 35)	$ 950.00
Three life memberships received during 1925	150.00
Total	$1,100.00

SECURITIES HELD.

(Liberty Bonds estimated at their face value.)

First Liberty Loan Bond, No. Boo 911,757	$ 50.00
Second Liberty Loan Bond, No. Bo2 787,752	50.00
Third Liberty Loan Bond, No. 5 876,279	50.00
Third Liberty Loan Bond, No. 5 876,278	50.00
Third Liberty Loan Bond, No. 5 876,280	50.00
Third Liberty Loan Bond, No. 4 203,250	100.00
Third Liberty Loan Bond, No. 4 203,251	100.00
Fourth Liberty Loan Bond, No. Ho5 321,828	100.00
Fourth Liberty Loan Bond, No. Co4 921,513	50.00
Fourth Liberty Loan Bond, No. D04 921,514	50.00
Fourth Liberty Loan Bond, No. EO4 921,515	50.00
Dominion of Canada Bond No. H 048,969	50.00
Second Liberty Loan Bond, No. AO1 943,836	100.00
Second Liberty Loan Bond, No. BO1 943,837	100.00
Second Liberty Loan Bond, No. DO1 943,834	100.00
Second Liberty Loan Bond, No. AO2 995,166	50.00
Total par value	$1,100.00

Respectfully submitted,

C. L. METCALF, *Treasurer.*

On motion the Treasurer's Report was accepted, subject to the approval of the Auditing Committee.

The next item of business was the

REPORT OF THE TREASURER OF THE THOMAS SAY FOUNDATION FOR THE YEAR 1925.

RECEIPTS.

Balance on hand January 1, 1925	$413.42
Sale of Volume 1	42.00
Sale of Volume 2	418.17
Advance Subscription for Future Volumes	5.00
Interest on Bonds	6.36
	$884.95

EXPENDITURES.

Printing Notice for Volume 2	$ 3.00
Mailing Boxes	10.25
Postage	33.18
Binding 47 copies, Volume 1	23.50
Paid Lafayette Printing Co. on Account	750.00
Balance in Bank	65.02
	$884.95

Cost of Printing Volume 2	$1,402.23
By cash to date	750.00
Balance due	$ 652.23

There are outstanding obligations to the original subscribers $64.00, and balance due on Volume 2 of $652.25, a total indebtedness of $716.25. Balance in treasury of $65.02 and $63.55 due on books, making a total of $128.57. This leaves a net deficit of $587.68.

J. J. DAVIS, *Treasurer.*

This report was accepted subject to the approval of the Auditing Committee.

It was moved and the motion carried that the Thomas Say Foundation Committee be asked to report at the next annual meeting suggestions of definite ways and means for enlarging the operations of the Foundation.

The next item of business was the

REPORT OF THE MANAGING EDITOR.

During the past year the Annals has been successful in printing a larger volume than at any previous time. This will include nearly 600 pages, 44 plates, and a number of text figures. The contents we believe are well up to the standard of any previous year and include papers of practically all branches of Entomology except strictly economic papers. Papers on physiology, morphology, embryology, taxonomy, life history, ecology, behavior, systematic and faunistic papers, while perhaps not in any strict proportion to the activity of the membership, are, I think, as nearly in a ratio of activity for this Society as can well be arranged in such a Journal. It shows distinctly the varied activity of the members of our Society in different phases of biological study of insects. Furthermore, while not strictly economic a great many of these papers have included matter which is of basic importance in the development of economic work. The various papers have covered nearly all of the principal groups especially the Hymenoptera, Diptera, Coleoptera, Lepidoptera, Hemiptera, Orthoptera. and the Arachnida. Geographically they have represented work in many different states, about twenty, and some foreign countries, and it is particularly encouraging that our connection with other countries has been so friendly especially for the Central and South American regions.

Our circulation now reaches every State in the Union, except one, The District of Columbia, Hawaii, Porto Rico, Panama, and the Philippines, and about twenty foreign countries including such widely scattered nations as Japan, India, Australia, New Zealand, Africa, and most of the European countries. It is interesting to note that eighteen copies of the Annals go to Japan, this being the largest foreign list except, naturally, Canada, which leads the foreign countries with about forty. It will be seen from this that the Journal is really an international organ for Entomology, a fact which we can note with gratification. Most of the circulation goes to the members of the Society, but the library and non-membership list now numbers 130 with a wide distribution. A number of back volumes have been sold during the year but we can still supply full sets for those who wish to complete the series and it should be noted that in accordance with the action of a year ago the price of back volumes will be advanced beginning with January, 1926.

We are again indebted to a number of authors for contributions toward the cost of publication, especially for the making of engravings, and several universities and experiment stations for contributing to publication and there seems to be a very legitimate use of our Journal in the publication of research work from such organizations, the plan having, it seems, a very definite mutual advantage provided the articles submitted are fully creditable and appropriate for the Journal. Of the thirty-two articles included in the year's volume, the majority have been by experienced workers and in the case of others, seven in number, presented by

younger workers, the papers have had a very careful supervision by well-known and experienced workers so that their quality cannot be doubted. Moreover, in such cases the author or institution has met a portion at least of the cost of publication. It seems very clear that provided the articles are of suitable quality that the assistance in publication in this manner is fully warranted as it means the possibility of increasing the size of the Journal without expense to the membership and at the same time affords a desirable avenue of publication to the research institution.

Financially, the year has been the most prosperous we have had as the income for the Editor's office for the first time exceeded $1,000.00, a considerable part of which must be credited to the contributions from authors and institutions. The accompanying statement of receipts and expenditures will indicate the source of income and nature of expenditures including the balance turned over to the treasury.

I wish again to express my appreciation of the cordial assistance given by the members of the Editorial Board and other members who have aided in the selection of papers, and especially to Dr. C. H. Kennedy, who has given most valuable assistance in details of work during the year.

I wish also here to express my obligation and I believe also the sincere appreciation of the society to the Printers, Spahr and Glenn, who have taken great pains to give us a creditable journal typographically, and to the Bucher Engraving Co. who have given us a very high grade of illustrations. Both of these firms have cooperated with us from the first number of the Annals in efforts to make the journal a credit to the society and to American science.

FINANCIAL STATEMENT.

RECEIPTS.

Subscriptions	$423.95
Sale of back volumes	178.85
Reprints and contributions	471.31
Total	$1,074.11

DISBURSEMENTS.

Engraving	$298.88
Postal charges and stamps	58.64
Stenographic and clerical help	25.10
Printing and incidentals	24.52
Remitted to Treasurer	666.97
	$1,074.11

HERBERT OSBORN, *Managing Editor.*

On motion this report was accepted subject to the approval of the Auditing Committee.

Professor Herbert Osborn next gave a report as Chairman of the Committee on Entomology in the National Museum. It was moved and the motion carried that this committee be requested to include as a supplement to each annual report a record of important additions to the Canadian National Collection and to the entomological collections in the various states. The report on the National Museum follows:

REPORT OF THE COMMITTEE ON NATIONAL MUSEUM.

The past year has been notable for the addition of two very important collections to the Entomological division of the National Museum and we are much pleased to call the attention of the Society to them as significant of what may be accomplished in the growth of the insect collections provided the interest of the Entomological workers may be enlisted and adequate support gained for the care

of such collections. The Casey collections of beetles, well known as of unusual extent and said to include some four or five thousand species represented by types, has been bequeathed to the Museum and awaits only facilities for arrangement, labeling and proper distribution in cases to make it available to specialists in Coleoptera. Such an extensive collection placed as an outright gift to the Museum is certainly worthy of comment and commendation as it is such cases as these that occupy the most unique and important position in the working collections of the nation. At present the collection is contanied in Schmitt boxes and much crowded and there is distinct need of additional curatorial service to place it in suitable condition for use.

Another important addition is the Dognin collection of Lepidoptera which is said to contain over three thousand American species represented by types and which must be second only to the Casey collection in extent and importance as a gift to the Museum. This latter we understand was purchased through the efforts of our enthusiastic member, Dr. Wm. Schaus, who by his personal gifts of persuasion induced friends and acquaintances to contribute a sum of $50,000 for the purchase of the collection. American Entomology certainly owes a debt of gratitude to Mr. Casey and to Dr. Schaus and his friends for these noteworthy additions.

The acquisition of these collections, however, makes it all the more imperative that there should be increased curator service for the collections as it is impossible to arrange and properly care for such collections without competent specialists, thoroughly qualified to handle them in the best possible manner. Moreover, there is little doubt but that the presence of these collections in the National Museum will make possible some important revisions and necessitate the publication of special monographs for the benefit of the Entomologists of the country. It is also very evident that additional service should be provided if other departments of the collections are to be developed and cared for in an adequate manner. The working up of Museum material and the preparation of papers setting forth the results of special studies involve a large amount of work and require a high degree of talent and there is every reason that specialists engaged in this work should be given the best possible opportunities for its prosecution.

Members of the society who may have opportunity to present these needs to members of Congress may be able to do a valuable service by calling attention to the importance of the National Collections.

(Signed), HERBERT OSBORN,
WM. BARNES,
W. M. WHEELER,
C. W. JOHNSON,
J. G. NEEDHAM,
Committee.

The Nominating Committee next reported as follows:

To the Entomological Society of America:

GENTLEMEN: We, the undersigned members of the Committee on Nominations, beg to report the following names as nominees for the respective offices for the year 1926:

For President—W. A. RILEY.
For First Vice-President—C. L. METCALF.
For Second Vice-President—ANNETTE F. BRAUN.
For Secretary-Treasurer—J. J. DAVIS.
For Additional Members of the Executive Committee—
For Term expiring Dec. 31, 1928—J. M. SWAINE, GEO. A. DEAN.
For Councillors to the American Association for the Advancement of Science—
W. E. BRITTON, P. P. CALVERT.

(Signed), ARTHUR GIBSON, *Chairman*,
H. B. HUNGERFORD,
R. W. HARNED.

By vote of the Society the report was accepted and the Secretary was instructed to cast the unanimous ballot of the Society for the election of the persons nominated. This being done they were declared elected.

The Society next received the report of the Committee on Resolutions which was as follows:

RESOLUTIONS ENTOMOLOGICAL SOCIETY OF AMERICA.

1. WHEREAS, many of the most important insect pests now occurring in the United States and Canada are of exotic origin and since there are many potential insect pests which may become a serious detriment to American Agriculture should they be introduced and become established. And furthermore, since it is known that difficulty has been experienced in the past in fighting newly introduced pests because of a lack of knowledge of the species in their native homes.

Be It Resolved, That this Society recognize the importance and value of a knowledge of insect life in foreign countries and we therefore urge the Secretary of Agriculture to establish, as rapidly as adjustments with foreign nations can be made, laboratories or observation stations in as many countries as possible, particularly in tropical countries, for the purpose of keeping records of insects likely to be introduced into the United States and to study the bionomics of the potentially important pests, so far as opportunities and facilities permit.

2. WHEREAS, We recognize the outstanding value of the International Entomological Congress and its bearing on international entomological solidarity, and inasmuch as such a congress has never been held in America,

Be It Resolved, That we express our desire for the holding of the 1928 Congress in the United States and suggest that the President of this society appoint a committee to investigate the matter and use their efforts to this end.

3. WHEREAS, Insect exhibits are recognized as an important and valuable part of our entomological gatherings,

Be It Resolved, That such exhibits be installed in rooms as near to the rooms where the meetings are held as possible and that in the future the Secretary arrange with the local committee for suitable quarters.

4. *Resolved further*, That the Entomological Society of America express its appreciation to the local committee of Kansas City, for the excellent and convenient accommodations and entertainment, and to the newspapers of Kansas City for their effective publicity.

J. J. DAVIS, *Chairman*,
CARL J. DRAKE,
J. A. HYSLOP.

On motion this report was adopted.

The Report of the Auditing Committee was made and accepted at the close of the Wednesday afternoon session. For convenience it is included here. The report is as follows:

REPORT OF THE AUDITING COMMITTEE.

KANSAS CITY, MO., Dec. 30, 1925.

To the Entomological Society of America:

GENTLEMEN: We, the undersigned Auditing Committee, have this day examined the accounts of C. L. Metcalf, Secretary-Treasurer of the Entomological Society of America for the year ending December 26, 1925; the accounts of Herbert Osborn, Managing Editor of the Annals for the year ending December 12, 1925; and the accounts of J. J. Davis, Treasurer of the Thomas Say Foundation, for the year ending December 30, 1925; and beg to report as follows:

1. The reports of the Treasurer of the Society, of the Managing Editor of the Annals and of the Treasurer of the Thomas Say Foundation correctly state the receipts and disbursements of the Society and the cash on hand as shown by the books.

2. Disbursements are confirmed by receipts from the payees, by cancelled checks, or by both, in the case of all payments except those made by the Treasurer of the Thomas Say Foundation, the vouchers for which, with one exception, have not been in the hands of the committee.

3. We recommend that all funds received by all officers be deposited in the bank and all payments made by check; and that the officers attach to the financial statement each year a bank statement confirming the deposits, payments and cash on hand.

(Signed), S. B. FRACKER, *Chairman*,
EDWIN C. VAN DYKE,
W. J. BAERG,
Committee.

Professor Herbert Osborn made a brief report upon the progress made with the plans for Biological Abstracts.

On motion of Arthur Gibson, a vote of thanks was given the retiring Secretary-Treasurer for his efficient services during the past five years.

Fourth Session, Wednesday Afternoon, December 30.

The Society was called to order at 1:30 P. M. in the Pompeian Room of the Hotel Baltimore in joint session with the American Association of Economic Entomologists, for a symposium on parasitism. President Dean presided. The following papers were presented:*

26. Opening Address: The Place of Parasitism in Insect Control. L. O. HOWARD, Chief U. S. Bureau of Entomology.
27. The Relation of Abundance of Parasites to Weather Conditions. V. E. SHELFORD, University of Illinois.
28. The Present Status of Control of Gipsy and Brown-Tail Moths by Means of Parasites. A. F. BURGESS, U. S. Bureau of Entomology. Read by Secretary Collins of the American Association of Economic Entomologists.
29. The Present Status of Biological Control Work in California. HARRY S. SMITH, California State Insectary. Read by W. B. Herms.
30. The Introduction and Establishment of the Alfalfa Weevil Parasite. T. R. CHAMBERLIN, U. S. Bureau of Entomology.
31. The Technic of Handling Parasites. D. W. JONES, U. S. Bureau of Entomology. Read by L. L. Huber.
32. The Effects of Parasitism on the Host and on the Parasite. WILLIAM B. HERMS, University of California.

Fifth Session, Wednesday Evening, December 30.

The Society was called to order at 8:30 P. M. by President Dean in the Pompeian Room of the Hotel Baltimore.

Dr. Vernon Kellogg, Permanent Secretary of the National Research Council, gave the annual public address on the subject: "Cooperation or Isolation in Science."

President Dean then introduced Dr. L. O. Howard, who gave an interesting report, illustrated with lantern slides, of the Zurich Con-

*To be published in April Number *Journal Economic Entomology*.

ference of Entomologists, which he attended as a delegate of the Society. See page 115.

Following these addresses the entomologists were tendered a smoker in the Venetian Room of the Hotel Baltimore by the entomologists of Kansas.

Respectfully submitted,

C. L. METCALF,
Secretary-Treasurer.

THE THIRD INTERNATIONAL CONGRESS FOR ENTOMOLOGY.

L. O. HOWARD

This Congress was held in Zurich, July 19th to July 26th, 1925. The writer had the pleasure of being present as a delegate from the American Association of Economic Entomologists, the Entomological Society of America, the Entomological Society of Washington and the Bureau of Entomology of the U. S. Department of Agriculture.

The congress was largely attended by delegates from nearly all of the European countries, the notable exceptions being France, Belgium, Italy and Russia. The writer was told by prominent entomologists in France that their absence from the congress was not due to international feeling, but to the unfortunate rate of monetary exchange. This general explanation was accepted by those present at the congress as fully accounting for the absence of delegates from the three countries first mentioned.

There was a notable attendance from Great Britain and her dependencies, more than fifty entomologists representing this part of the English-speaking peoples. From the United States there were only five. Those in addition to the writer were Prof. O. A. Johannsen, Dr. W. R. Thompson, Mr. S. M. Dohanian and Dr. E. Graenicher. There was a large attendance from Germany, Austria, Hungary, Holland, Sweden, Spain, and, naturally from Switzerland. Denmark, Poland, Czechoslovakia, Finland and Esthonia, were also represented. The writer was not able to get the full registration, but Mr. Charles Hose, who represented the Royal Colonial Institute of Great Britain, in an excellent account published in *The United Empire* for November, 1925, estimated it at 354. This, however, includes the ladies accompanying delegates.

The President of the Congress was Dr. A. V. Schulthess-Rechberg, a man of high standing and impressive personality, great tact and courtesy. The arrangements of the congress were admirable, and everything passed off smoothly. The Secretary, Dr. H. Kutter, is to be congratulated on the excellent results of his hard work. The admirable plan of program adopted at the two previous congresses was followed. On each morning there was a general session, with sectional meetings in the afternoons. For each of the general sessions there was an especial president, or chairman, and at these morning meetings papers of general interest were read. The chairmen of the general sessions, in orders, were, the writer, Dr. A. Handlirsch, Prof. Ed. Everts, Prof. J. Jablonowski, and Prof. E. B. Poulton. Of the sectional meetings, Dr. H. Heymons was to have presided the first day over the section of Morphology, Anatomy and Physiology, Herr M. Schwartz over the section of Systematics and Geographical Distribution, Dr. G. A. K. Marshall

over the section of Nomenclature and Bibliography, Prof. E. W. Carlier over the section of Biology and Evolution. At later sectional meetings Dr. Y. Sjostedt presided over the section of Systematics and Geographical Distribution, Prof. J. F. van Bemmelen over Biology and Evolution, Prof. L. Reh over Applied Entomology. Still later Prof. R. Bledowski over the section of Biology and Evolution; Dr. R. S. MacDougall, section of Applied Entomology; Prof. W. Petersen, Systematics and Geographical Distribution; Father E. Wasmann, Nomenclature and Bibliography; Dr. J. Tragardh, Applied Entomology; Prof. G. H. F. Nuttall, Morphology, Anatomy and Physiology; Rev. G. Wheeler, Systematics and Geographical Distribution; Dr. C. Boerner, Biology and Evolution.

There were some admirable papers of broad bearing presented before the general sessions; for example, Prof. F. Ris, on "The Geographical Distribution of Insects in Switzerland"; Dr. R. T. Leiper, "Some Outstanding Questions in Medical Entomology"; Prof. E. B. Poulton, on a question of mimicry with certain African Lepidoptera; Dr. K. Escherich on "The Development of Applied Entomology in Germany"; Professor Pictet, on "Parthenogenesis and the Numerical Equality of the Sexes with Lepidoptera"; an important teleological paper by Doctor Handlirsch, and another by Professor van Bemmelen on mimicry, one by Doctor Tragardh on some methods of research in forest entomology, another by Dr. G. Horvath on the distribution of Hemiptera; Mr. Balfour-Brown on the evolution of social life among caterpillars, and still another by Mr. C. B. Williams on some unsolved problems of butterfly migrations—all attracted much attention; while still another by T. Bainbrigge Fletcher on entomology in India, and by Father Wasmann on mimicry between certain Staphylinids and their hosts, were listened to with great interest.

Applied entomology was recognized, as was naturally to be expected, as of rapidly increasing importance. In the special session just mentioned the papers by Escherich, Tragardh, Fletcher and Leiper dealt with economic matters. The meetings of the section on applied entomology were especially well attended. Important papers were read, by MacDougall on the ox warble, by Boerner on plant-lice, by Prell on the polyhedral diseases of insects, by Urich on economic entomology in the tropics, by Dampf on color changes in migratory locusts, and by Escalara on the introduction of gypsy moth parasites into Algeria. MacDougall also read a paper on the Coccid enemies of the banana. Dr. Leiper's paper on "Some Outstanding Questions in Medical Entomology," was, by the way, rather vigorously discussed, since he had taken the stand that entomologists were apparently not taking sufficient interest in questions of medical entomology. This point was emphatically denied in the discussion by Doctor MacDougall, Mr. T. B. Fletcher and the writer.

While many languages were used, the predominating speech was either German or English. The English-speaking delegates were especially pleased by the opening remarks by Doctor Tragardh, who spoke in English and who stated in his opening sentence that, while he was

sure that if he should speak in Swedish he would not be understood, he had the choice of German or English which he spoke equally well but chose to use English since he considered it to be a more nearly universal language than any other.

The language question is always a difficult one in an international congress; less so, perhaps in scientific ones than in others, since we must all read almost all languages. But without calling on my reserve of anything but English I found that language spoken by very many Europeans, even by some who did not attempt its use at Oxford. Schultess, Wasmann, Tragardh, Jablonowski, Everts, Bolivar, Handlirsch, Spaeth, Kryger, Prell, van Bemmelen, Ris, Efflatoun of Egypt, Faes, Friederichs, Horn, Sjostedt, and very many others spoke excellent English; while many more had enough to make themselves easily understood, although I doubt whether they fully comprehended the English papers and discussions in that language. On the other hand, many of the English-speaking delegates were adept in German and some of the other languages. Nuttall and Urich appeared perfectly at home in that language and were of much assistance in the discussions and announcements. Hugh Scott of Cambridge seemed to speak any language fluently. And then there was an extraordinary young woman in the Secretary's office, Miss Kathe Biske, who seemed perfectly at home in all languages. She is a student at the University of Zurich, and I understand is a Russian by birth.

There were a number of extremely pleasant social features, including the opening reception on Sunday night, July 19th, an excursion on Lake Zurich on Thursday afternoon, the 23rd, and a final dinner on the 24th which was very largely attended and at which many excellent speeches were made. After adjournment on Saturday, there were excursions to different parts of Switzerland.

The Executive Committee held frequent sessions during the meetings, and discussed many matters of broad interest to entomologists. It was decided to hold the fourth congress in 1928. The place was not chosen, but it was generally understood that if possible arrangements would be made to hold it in the United States. The election of officers for the congress was left until the place should be decided. The only objection to the choice of the United States was a financial one. It was deemed certain that the attendance of Europen entomologists would be very restricted on account of the expense of the journey, and members of the Executive Committee expressed to the writer the hope that the American entomologists would be able to lessen the expense to European delegates in some way or another. A number of suggestions were made, but the matter was left in the hands of the entomologists of America.

There is some doubt as to the publications of the proceedings of the congress. At last information funds were lacking, and it is feared that the entomological world must wait at least for some months before it can read the papers and discussions. Doubtless many of the papers will appear in some of the periodical publications, and doubtless also the conclusions of the Executive Committee will be published elsewhere. Of reports of the meeting, I know of five at this date of writing—one by

Dr. R. Stewart MacDougall, in *Nature*, August 15, 1925, pp. 259-260; one by Mr. Charles Hose, already referred to, in *The United Empire* for November, 1925, pp. 682-684; one by the writer in the November number of *Entomological News*, one by A. Muller in the *Zeitschrift fur Angewandte Entomologie*, Heft 10, 1925 (rec'd Nov. 16), to be continued in future numbers of the same journal, and one by A. Zerkowitz in the *Internationale Entomologische Zeitschrift* for the 22nd of October, 1925, pp. 210-211.

Should the next congress be held in the United States, we shall not be in position to complain if there is a very small attendance of Europeans, since, of the five Americans at the Zurich congress, it is sad to relate that not one crossed the Atlantic especially for the congress, but all were in Europe for some other main purpose. The American leaders in entomology who were so much in evidence at the Oxford congress in 1912, (Comstock, Skinner, Holland, Calvert, Osborn, Kellogg, Forbes, Wheeler and Needham), were absent at Zurich.

The writer was more impressed than ever of the value of these international meetings. Occasional personal contact is a great pleasure and an enormous stimulus. It is true that entomologists all over the world are a mutually helpful lot, but this desire to help becomes greater after personal acquaintance and conversation about details and conditions. While it is true that the old general attitude towards entomologists—of depreciation of his standing as a man of science—is rapidly passing away, the individual none the less is greatly encouraged to find himself one of a large group of men of similar tastes and to see what fine men they are. The extraordinary group photograph which was taken of the congress shows a group of 250 people who would stand comparison with any other international group that could be selected.